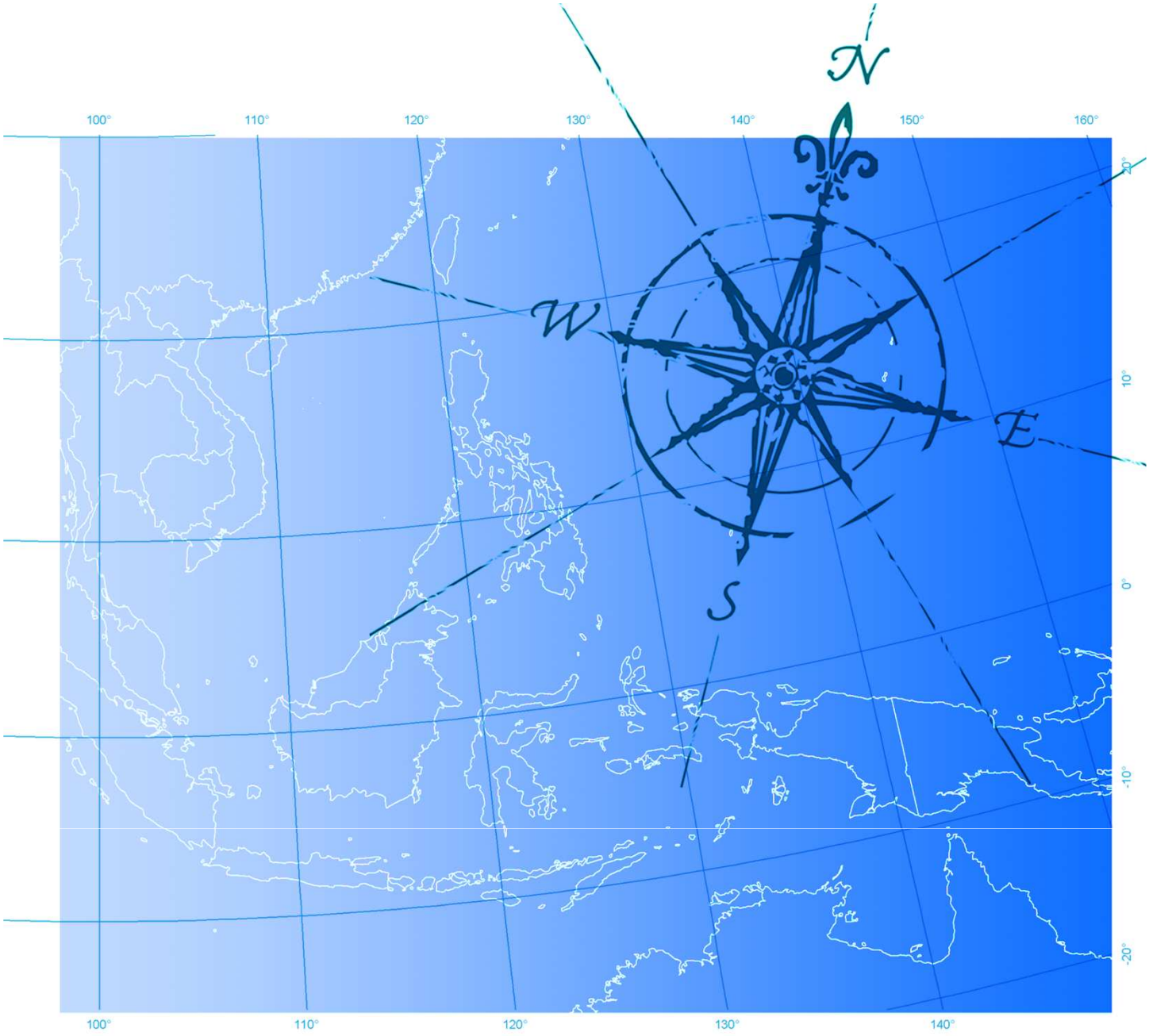


# Climate Change Vulnerability Mapping for Southeast Asia

Arief Anshory Yusuf & Herminia Francisco

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EEPSEA was established in May 1993 to support research and training in environmental and resource economics. Its objective is to enhance local capacity to undertake the economic analysis of environmental problems and policies. It uses a networking approach, involving courses, meetings, technical support, access to literature and opportunities for comparative research. Member countries are Thailand, Malaysia, Indonesia, the Philippines, Vietnam, Cambodia, Lao PDR, China, and Papua New Guinea.

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# ABSTRACT

This paper provides information on the sub-national areas (regions/districts/provinces) most vulnerable to climate change impacts in Southeast Asia. This assessment was carried out by overlaying climate hazard maps, sensitivity maps, and adaptive capacity maps following the vulnerability assessment framework of the United Nations' Inter-governmental Panel on Climate Change (IPCC). The study used data on the spatial distribution of various climate-related hazards in 530 sub-national areas of Indonesia, Thailand, Vietnam, Lao PDR, Cambodia, Malaysia, and the Philippines. Based on this mapping assessment, all the regions of the Philippines; the Mekong River Delta in Vietnam; almost all the regions of Cambodia; North and East Lao PDR; the Bangkok region of Thailand; and West Sumatra, South Sumatra, West Java, and East Java of Indonesia are among the most vulnerable regions in Southeast Asia.



Keywords: climate change vulnerability; Southeast Asia

# 1.0 INTRODUCTION

The United Nations Climate Change Conference held in Bali, Indonesia, in December 2007 acknowledged, among other things, the need for enhanced action on adaptation and the provision of financial resources for it. This, in turn, implies the need for financial and technology transfer from the rich to the poor countries. In general, most developing countries in Asia have the least capacity to adapt to climate change and are therefore in need of whatever external support they can get to build their capacity (Francisco 2008).

As the long history of international climate change agreements tells us, resource transfers from rich to poor countries not only require a common and shared vision among the countries, but also involve long and complex political processes. Acknowledging the fact that in a resource-constrained world, there is a benefit and cost to every action, it is then essential for the resources available to be well targeted to the people who need them the most; those located in the areas most vulnerable to climate change.

The identification and characterization of the vulnerable communities and sectors were identified as priority concerns by the participants of the EEPSEA Climate Change Adaptation Conference held in Bali in February 2008. Identification of the most vulnerable groups by way of determining the most vulnerable regions within countries and in Southeast Asia as a whole is thus an urgent task for development agencies. This paper addresses this need.

# 2.0 OBJECTIVES

The general objective of this study is to identify which regions in Southeast Asia are the most vulnerable to climate change. It is expected that this information will be useful to policy-makers of the region as well as external donors in better targeting their support towards climate change efforts. The specific objectives are as follows:

1. To identify which sub-national areas/units (regions, provinces, or districts, depending on the availability of the data) of Southeast Asian countries (Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and Philippines) are the most vulnerable to climate change.

2. To show these vulnerable areas in a map for ease of reference of interested parties.

# 3.0 METHODOLOGY AND DATA

Identifying climate change vulnerability requires a clear conceptual framework. We started by adopting the concept contained in the Third Assessment Report of the IPCC where vulnerability is defined as: "The degree to which a system is susceptible to, or unable to cope with the adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity" (IPCC 2001, p.995). Vulnerability can thus be defined as a function of exposure, sensitivity, and adaptive capacity, or:

$$\text{Vulnerability} = f(\text{exposure, sensitivity, adaptive capacity})$$

In the IPCC report, **exposure** is defined as "the nature and degree to which a system is exposed to significant climatic variations"; **sensitivity** is defined as "the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli[1]"; and **adaptive capacity** is defined as "the ability of a system to adjust to climate change (including climate variability and extremes), to moderate the potential damage from it, to take advantage of its opportunities, or to cope with its consequences".

We used the above conceptual framework to do a 'quick' assessment of the 'current' vulnerability of selected Southeast Asian countries based on past as well as the most recently available data. We emphasize the term 'quick' as this effort should be considered as a first cut of sorts since this work was largely dependent on whatever information we could get from public sources (such as the internet) and climate change experts in the region. We used the inputs of a select group of climate and social scientists from the region, obtained through a Climate Change Experts Consultation Meeting held with them in Bangkok in the middle of 2008.

The main limitation of our assessment was our inability to factor in projections of climate change and socio-economic conditions for the coming years. However, given that the future trajectory of climate change events and socio-economic conditions is so uncertain, we feel that such an analysis would be hard to sell in any case. It is far more reliable to use historical data as current vulnerability is likely to worsen than improve. Naturally, there is room for fine-tuning this assessment to take into account scientifically acceptable projections on future climate change impacts as well as projected changes in socio-economic conditions. Detailed sub-national information on the various indicators of adaptive capacity should be collected, given more time and resources. However, we shall leave such improvements to future studies on this topic.

Our motivation in coming up with this map is to provide some indications on how the limited (developmental and research) resources available for adaptation work could be best directed across

[1] The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).

countries in the region and across sub-national areas within a country. The identification of specific adaptation support or research for the different locales should then be carried out.

## 3.1 Vulnerability Assessment

To identify the vulnerable regions, we constructed an index of the climate change vulnerability of sub-national administrative areas in seven countries in Southeast Asia, i.e., Vietnam, Laos, Cambodia, Thailand, Malaysia, the Philippines, and Indonesia. The assessment considers 530 sub-national areas comprising 341 districts (*kabupaten/kota*) in Indonesia, 19 provinces (*khet*) in Cambodia, 17 provinces (*khoueng*) in Lao PDR, 14 states (*negeri*) in Malaysia, 14 provinces in the Philippines, 72 provinces (*changwat*) in Thailand, and 53 provinces (*tinh/thanh pho*) in Vietnam.

The climate change vulnerability index was derived through the following steps:

- We assessed exposure using information from historical records of climate-related hazards as we considered past exposure to climate risks as the best available proxy for future climate risks.
- We obtained climate hazard maps for five climate-related risks: tropical cyclones, floods, landslides, droughts, and sea level rise.
- We used population density as a proxy for human sensitivity to climate-hazard exposure. The assumption here is that regions that are relatively less inhabited will be less vulnerable compared to regions with high population densities, given the same degree of exposure to climate hazards.
- In addition to the human aspect of vulnerability, we also included ecological sensitivity of the region using biodiversity information as a proxy variable. A biodiversity-rich region, measured by the percentage of protected areas, is thus considered here as more vulnerable than other areas to climate hazards, other things being equal.
- We constructed an index of adaptive capacity as a function of socio-economic factors, technology, and infrastructure.

Based on the above, we constructed an index of the overall climate change vulnerability of the region. Figure 1 illustrates the steps we took in constructing the index.

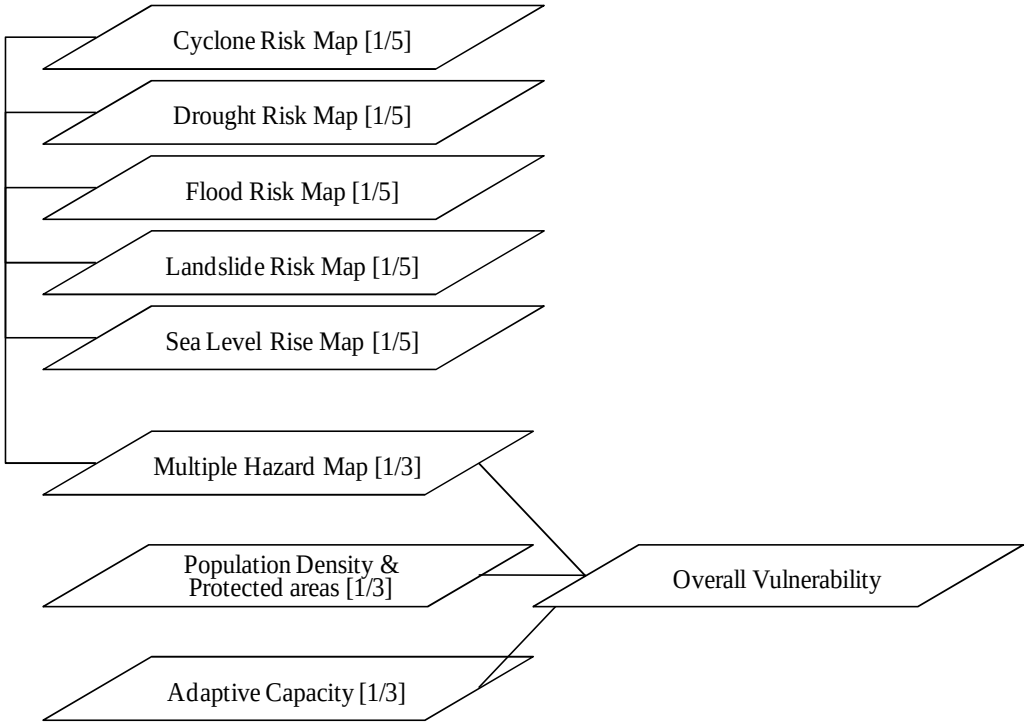


Figure 1. Method used in deriving the climate change vulnerability index

Note: The figures in parenthesis indicate the weights given to the respective factors.

## 3.2 Generating the Component Maps for the Vulnerability Assessment

As shown in Figure 1, we derived the overall climate change vulnerability index by overlaying a series of maps. These maps are described below. (Please refer to Appendix 1 for the sources of the data used in this vulnerability mapping project.)

### 3.2.1 Climate hazard maps

First, we obtained maps (in grid/raster format) for five different climate hazards: the frequency of droughts, floods, and cyclones, for about 20 years (1980-2000/1/3), physical exposure to landslides, and inundation zones of a five-meter sea level rise. The maps of these five hazards are given in Appendix 2.

Then, to make the maps comparable, we normalized each of them using the following formula:

$$Z_{i,j} = \frac{X_{i,j} - X_i^{MIN}}{X_i^{MAX} - X_i^{MIN}}$$

where $Z_{i,j}$ is the standardized climate hazard of type i of region j; $X_{i,j}$ is the unstandardized climate hazard of type i of region j; $X_i^{MAX}$ is the maximum value of the climate hazard indicator over region j, and $X_i^{MIN}$ is the minimum value of the climate hazard indicator over region j. A similar standardization method is used by the UNDP to calculate the Human Development Index.

Thirdly, we used the simple average of the five standardized climate hazard indicators, thus overlaying all five hazard maps onto one single multiple hazard map. Since we did not have knowledge of the degree of importance of each hazard in assessing the vulnerability, we assumed equal weights for all.

Figure 2 is the overall climate hazard map showing the combination of climate-related hazards (tropical cyclones, floods, landslides, droughts, and sea level rise) and the hotspots in Southeast Asia. The latter includes the north-western and Mekong region of Vietnam, the coastal regions of Vietnam facing the South China Sea, Bangkok and its surrounding areas in Thailand, practically all the regions of the Philippines, and the western and eastern parts of Java Island, Indonesia. Table 1 lists the climate hazard hotspots and their dominant hazards.

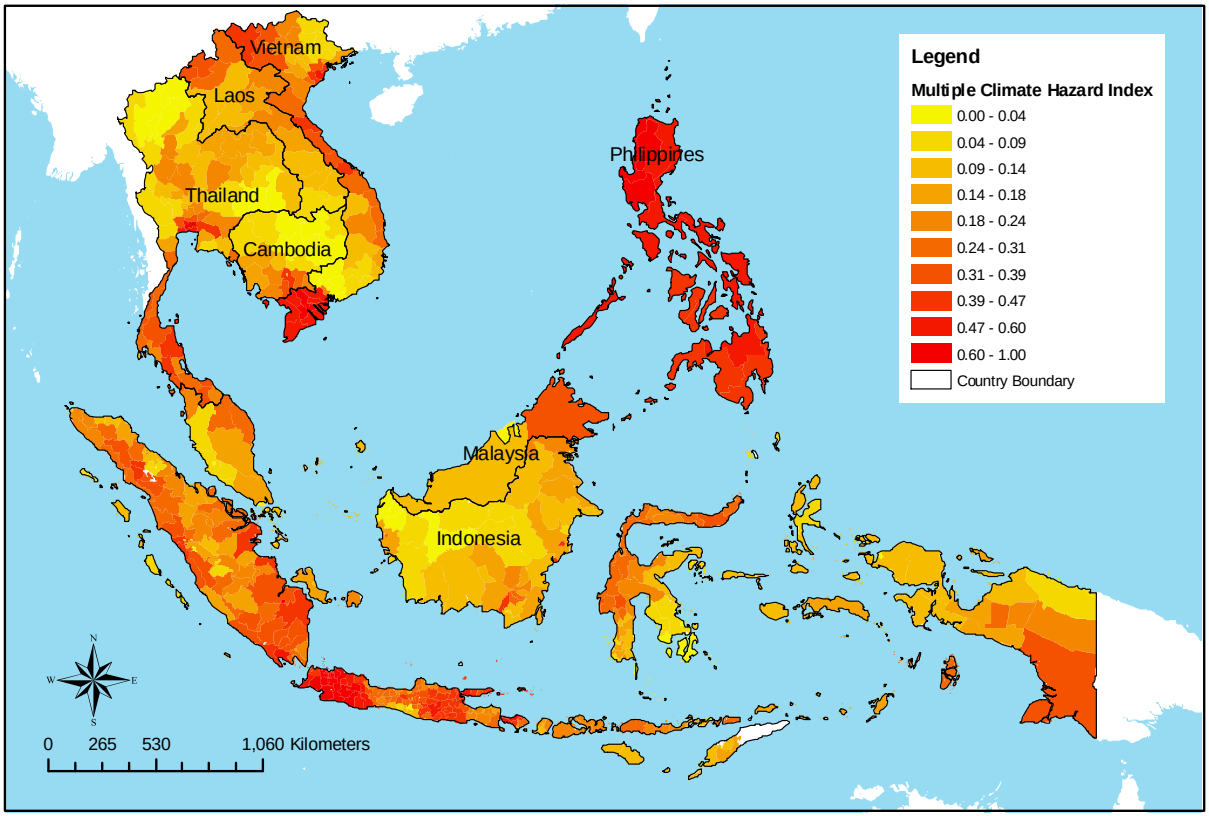


Figure 2. Multiple climate hazard map of Southeast Asia

Note: For the legend, the scale used is 0-1 indicating the lowest vulnerability level (0) to the highest vulnerability level (1).

Table 1. Climate hazard hotspots and dominant hazards

| **Climate hazard hotspots** | **Dominant hazards** |
|---|---|
| Northwestern Vietnam | Droughts |
| Eastern coastal areas of Vietnam | Cyclones, droughts |
| Mekong region of Vietnam | Sea level rise |
| Bangkok and its surrounding area in Thailand | Sea level rise, floods |
| Southern regions of Thailand | Droughts, floods |
| The Philippines | Cyclones, landslides, floods, droughts |
| Sabah state in Malaysia | Droughts |
| Western and eastern area of Java Island, Indonesia | Droughts, floods, landslides, sea level rise |

### 3.2.2 Human and ecological sensitivity maps

We obtained the population density maps from the Urban Extent Database (GRUMP version 1) of the Center for International Earth Science Information Network (CIESIN), which showed the number of people per square kilometer in 30-arc-second (1-km) resolution. We converted the unit of observation from the 1-km resolution into province/district by averaging across administrative boundaries. This produced maps of average population density for each of the provinces/districts in the region. These were used as indicators of human sensitivity.

The ecological sensitivity map was obtained using data on protected areas from the Terrestrial Ecoregions GIS Database of the World Wildlife Fund (WWF). We calculated the share of area within each province/district designated as protected areas over the total land area of the province/district.

The overall sensitivity map encompassing both human and ecological factors was derived using the weighted averages of the standardized values of population density and protected area (as a share of total area) for each of the provinces/districts. We chose to use a higher weight of 0.70 for population density (with 0.30 for protected areas) because of the higher importance we attached to human sensitivity.

Figure 3 shows the map of population density and protected areas. The figure shows that Java is the most densely populated island in the region. Other highly populated areas are northeastern Vietnam (around the capital), Bangkok, and around the national capital of the Philippines.

Thailand, Cambodia, and Lao PDR have relatively more protected areas compared to other countries in the region. The largest protected areas in Southeast Asia are the Foga region in Papua island, Mount Leuser National Park in northern Sumatra, the Sungai Kayan-Sungai Mentarai Nature Reserve in North Kalimantan, the Thung Yai Naresuan Wildlife Sanctuary in eastern Thailand, Palawan Island of the Philippines, the Nakai-Nam Theun National Biodiversity Conservation Park of Lao PDR, and the Mondulkiri Protected Forest of Cambodia.

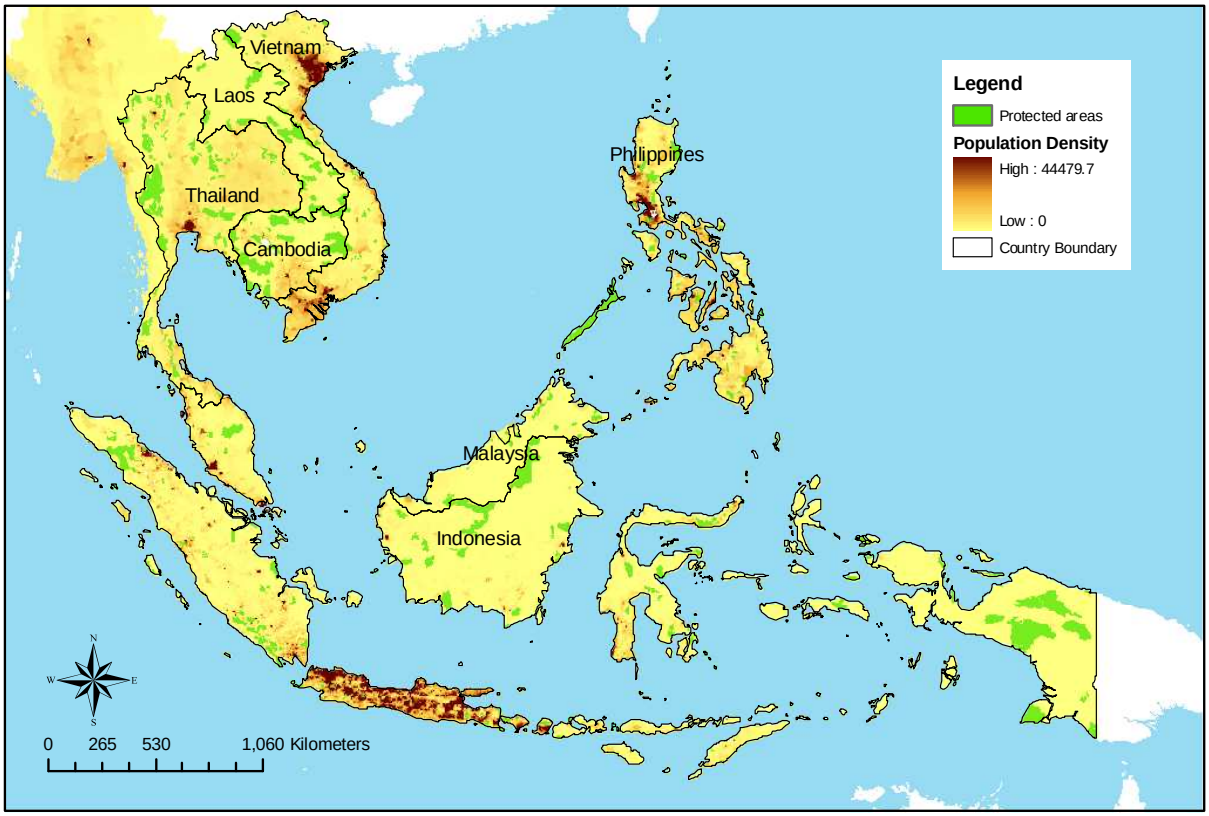


Figure 3. Human (population density) and ecological (protected areas) sensitivity map of Southeast Asia (2000)

### 3.2.3 Adaptive capacity map

Adaptive capacity is defined as the degree to which adjustments in practices, processes, or structures can moderate or offset potential damage or take advantage of opportunities (from climate change). It can be written in equation form as follows:

$$\text{Adaptive Capacity} = f(\text{socio-economic factors, technology, infrastructure})^2$$

The Climate Change Experts Consultation Meeting held in Bangkok in mid-2008 resulted in an operational framework to measure adaptive capacity, using selected indicators. We used 'expert opinion polling' to arrive at the weights assigned to the various climate change indicators shown in Figure 4.

[2] Initially included in the function of adaptive capacity was "policy and institutions'. However, due to lack of data availability across sub-national areas in SEA, the variable was dropped from this analysis.

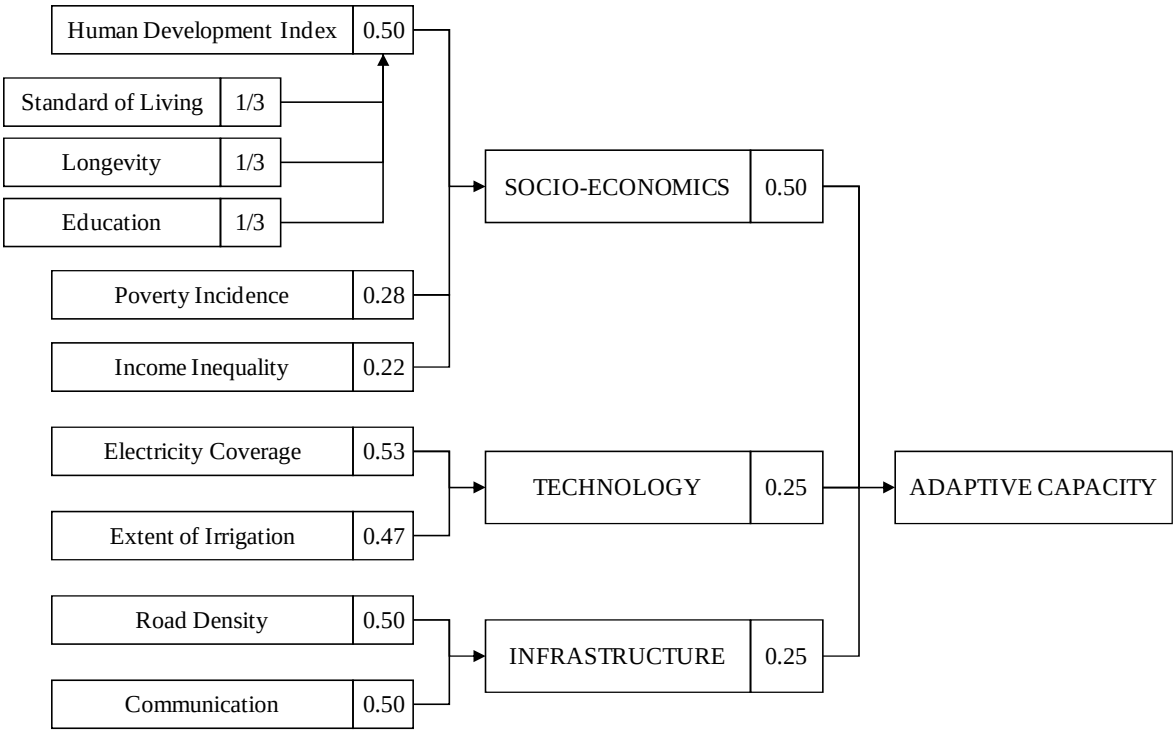


Figure 4. Adaptive capacity assessment

Figure 5 below is a map showing the adaptive capacity of Southeast Asia[3]. Overall, areas with relatively high adaptive capacity lie in Thailand, Malaysia and Vietnam whereas areas with relatively low adaptive capacity are mostly found in Cambodia and Lao PDR.

[3] See Appendix 1 for details on the adaptive capacity calculations.

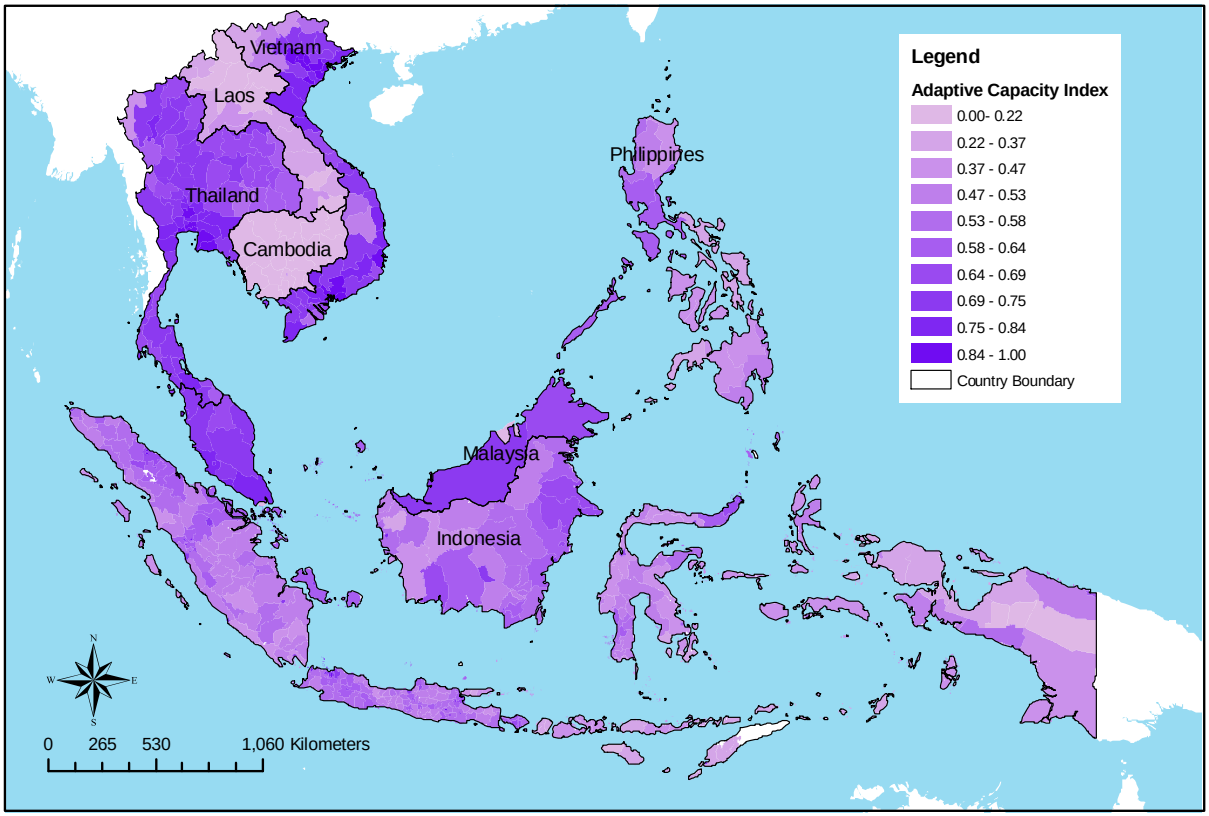


Figure 5. Adaptive capacity map of Southeast Asia (2005)

# 4.0 OVERALL CLIMATE CHANGE VULNERABILITY MAP OF SOUTHEAST ASIA

To obtain the overall index of climate change vulnerability, we averaged each of the normalized indicators of exposure (multiple hazard risk exposure), sensitivity (human and ecological), and adaptive capacity. To identify the vulnerable areas, we ranked the regions according to the index and divided the list into four equal parts. Those provinces/districts falling in the fourth quartile were considered the vulnerable areas and further classified as mildly vulnerable, moderately vulnerable, or highly vulnerable.

We used two different ways of ranking the areas: first, across the whole of Southeast Asia, and second, within each of the selected countries[4]. This was done simply to rank priority areas for adaptation interventions by different users of this mapping information. Figure 6 shows the map of climate change vulnerability in Southeast Asia while Figures 7 and 8 show the vulnerable areas by region (SEA) and

[4] For the Southeast Asia standard, the fourth quartile regions are further classified into three categories: mild vulnerability (with an index interval of 0.33-0.46), moderate vulnerability (0.47-0.67), and high vulnerability (0.68-1.00). For the country standard, the index intervals for the mild, moderate, and high vulnerability categories are 0.18-0.42, 0.43-0.65, and 0.66-1.00, respectively. These categories were set using ArchMap software which best groups similar values and identifies big jumps in datasets.

country standards, respectively. The two tables in Appendix 3 list the vulnerable areas, showing the vulnerability indices and components.

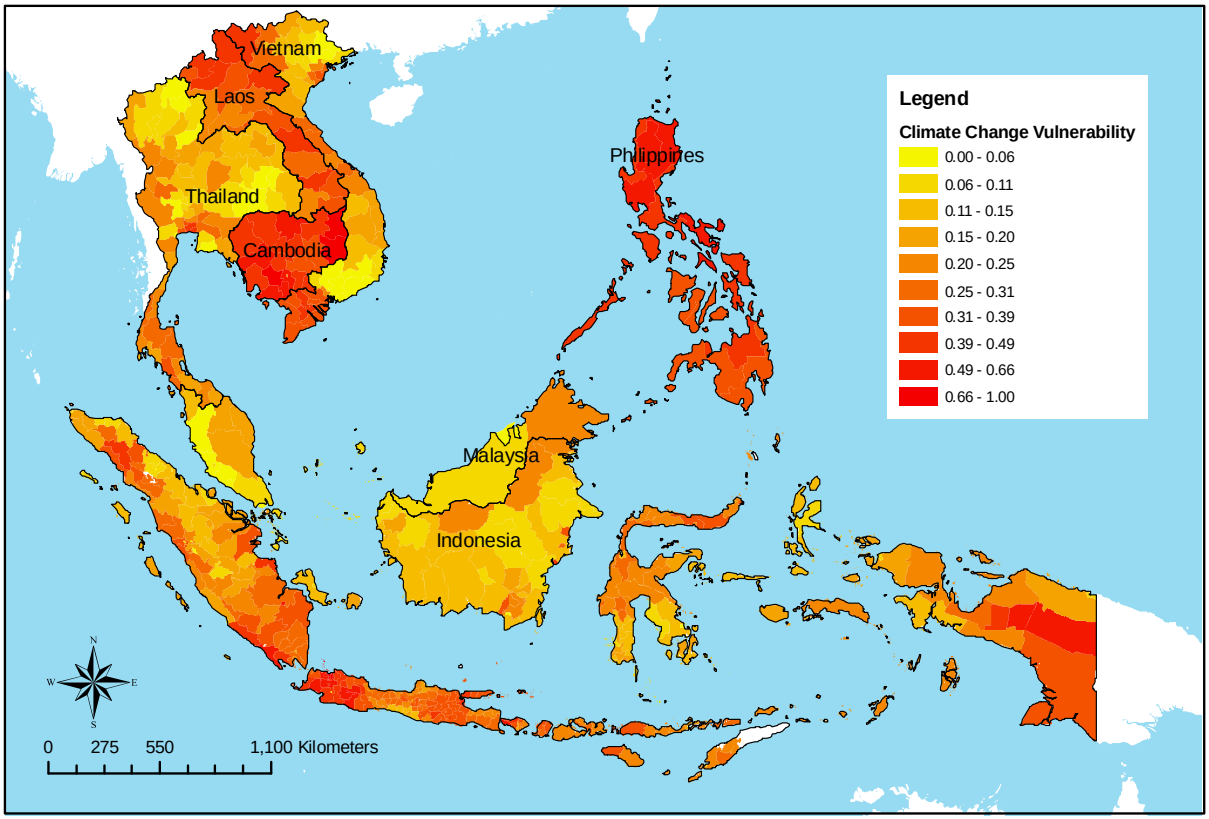


Figure 6. Climate change vulnerability map of Southeast Asia

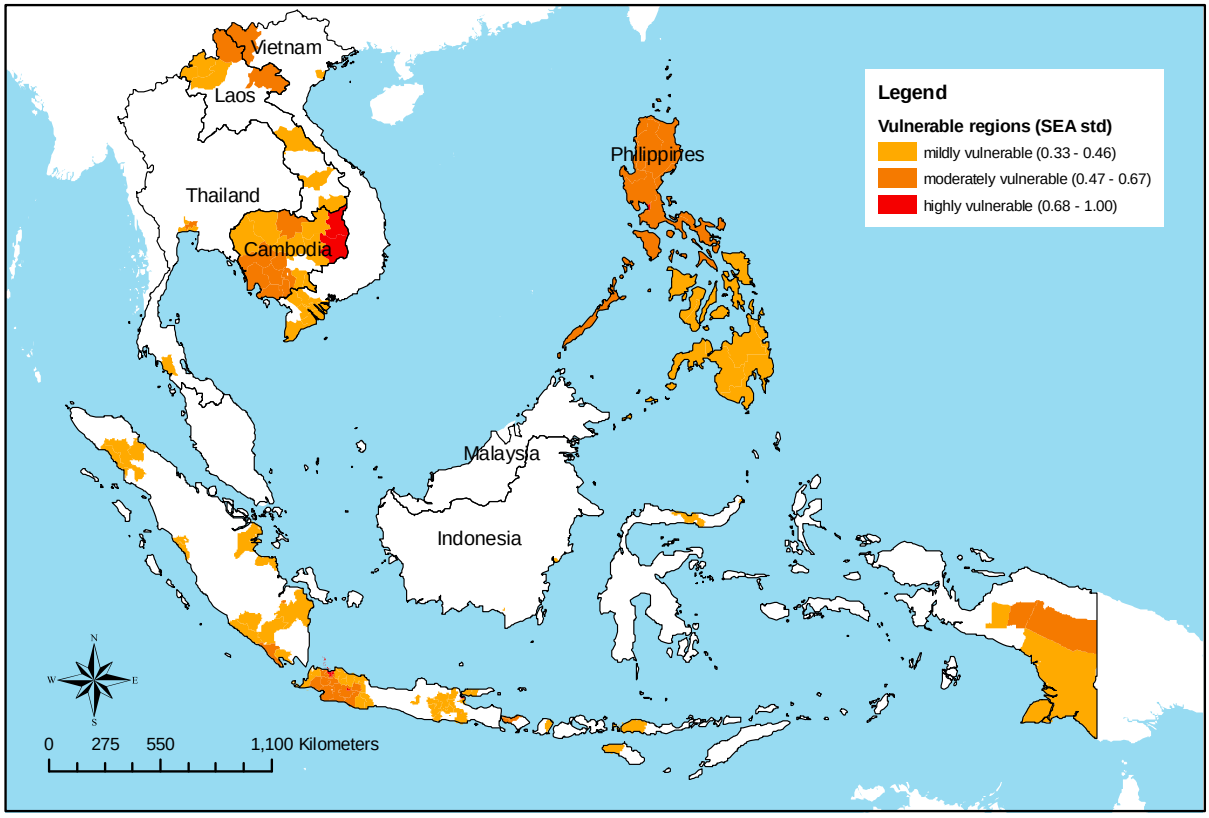


Figure 7. Map of the most vulnerable areas in Southeast Asia (regional standard)

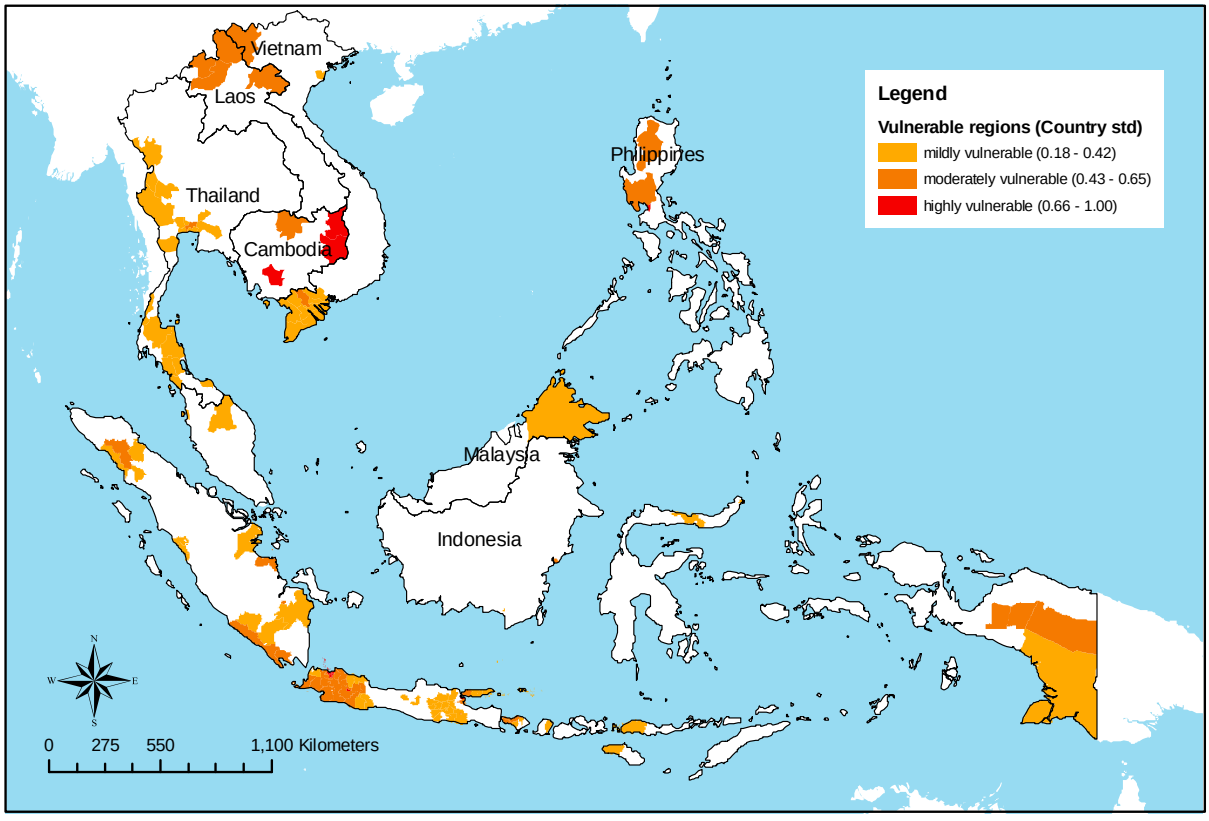


Figure 8. Map of the most vulnerable areas in Southeast Asia (country standard)

As can be seen from Figure 7, we identified the most vulnerable areas using the Southeast Asian standard of those falling within the top/fourth quartile. These areas include: all the regions of the Philippines, the Mekong River Delta region of Vietnam; almost all the regions of Cambodia; North and East Lao PDR; the Bangkok region of Thailand; and the west and south of Sumatra, and western and eastern Java in Indonesia. The Philippines, unlike other countries in Southeast Asia, is not only exposed to tropical cyclones, especially in the northern and eastern parts of the country, but also to many other climate-related hazards especially floods (such as in central Luzon and Southern Mindanao), landslides (due to the terrain of the country), and droughts.

Figure 8 reflects the most vulnerable regions within countries i.e., those in the top quartile relative to other areas within each country. Using this standard, we find that in Malaysia, the most vulnerable regions are the states of Kelantan and Sabah. In the Philippines, the areas with the highest vulnerability are the National Capital Region, Southern Tagalog, Cagayan Valley, Central Luzon, the Cordillera Administrative Region, and Bicol Province. The National Capital Region of the Philippines, which is densely populated, is particularly susceptible to multiple climate hazards (especially cyclones and floods).

In general, these results provide no surprises as they confirm commonly-held suspicions that the most vulnerable regions in Southeast Asia include the Mekong River Delta in Vietnam and Bangkok due to their exposure to sea level rise, as well as the northern part of the Philippines due to its exposure to tropical cyclones.

Notwithstanding this, some surprises did arise. Although most regions in Cambodia were relatively not highly exposed to climate hazards, except those sharing borders with the Mekong River Delta in northern Vietnam (which is susceptible to flooding and sea level rise), almost all the provinces in Cambodia are vulnerable due to their low adaptive capacity.

In the overall assessment, however, the districts of Jakarta in Indonesia come out as the top most vulnerable regions in Southeast Asia (see Appendix 3). Moreover, the areas in western and eastern Java are also vulnerable using the regional standard. Central Jakarta ranks first in the overall vulnerability assessment even though it has the highest adaptive capacity index. This is because this district is the intersection of all the climate-related hazards, except tropical cyclones. It is frequently exposed to regular flooding but most importantly, it is highly sensitive because it is among the most densely-populated regions in Southeast Asia. Areas in western Java are also highly vulnerable due to exposure to multiple hazards (namely, floods and landslides) as well as having high population densities.

Adaptive capacity seems to play important role in changing the spatial pattern of vulnerability. Low adaptive capacity has made Cambodia among the most vulnerable regions despite its relatively low exposure to climate hazards. On the other hand, the high adaptive capacity of the eastern coast of Vietnam, which is susceptible to cyclones, has managed to moderate its vulnerability, hence it is not included among the most vulnerable areas of Southeast Asia. This is not generally true, however, for

other areas where high adaptive capacity does not help to moderate exposure to climate risks. Bangkok and Jakarta are good examples. Their high adaptive capacities are not enough to moderate their extreme vulnerability brought about by their high population densities and significant exposure to climate hazards (in particular, sea level rise and floods).

## 5.0 CONCLUDING REMARKS

The identification of the areas most vulnerable to climate change risks in Southeast Asia is among the most urgent of policy needs. This assessment responds to this need by identifying which provinces/districts in Southeast Asian countries (namely, Thailand, Vietnam, Laos, Cambodia, Indonesia, Malaysia, and the Philippines) are the most vulnerable to climate change, and producing a map to show climate change vulnerability in the region. We gathered data, at province and district levels, from various sources and integrated them in a consistent and meaningful manner to produce a map indicating the areas most vulnerable to climate change. Despite data limitations, it is expected that the output of this analysis will be useful to policy-makers and donors in better targeting financial resources towards adaptation measures undertaken in Southeast Asia.

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# APPENDICES

## Appendix 1. Sources of Data

The data used in this vulnerability assessment came from different sources and in various formats such as the GIS map format (both grid/raster and SHP) and EXCEL data format. A detailed explanation of the sources of the data and how the figures were calculated is given below.

- **Sub-national Administrative Areas**

Data on sub-national administrative areas was available in ESRI SHP format. For sub-national administrative areas (such as provinces), the data came from the GEODATA portal (the Environmental Database; http://geodata.grid.unep.ch/extras/datasetlist.php). Since Indonesia was the biggest country in terms of area, instead of using provinces as the unit of analysis, we used districts instead. The data on district administrative boundaries for Indonesia was obtained from BAKOSURTANAL (or the National Coordinating Body for Land Surveys).

In all, there were 530 sub-national areas/units in this assessment which were made up of 341 districts (*kabupaten/kota*) in Indonesia, 19 provinces (*khet*) in Cambodia, 17 provinces (*khoueng*) in Lao PDR, 14 states (*negeri*) in Malaysia, 14 provinces in the Philippines, 72 provinces (*changwat*) in Thailand, and 53 provinces (*tinh/thanh pho*) in Vietnam.

- **Climate Hazards**

*Frequency of tropical cyclones, floods, and droughts, and exposure to landslides*

The frequency of tropical cyclones, floods, and droughts was measured in terms of number of events per year. The cells in the maps indicate the number of events, divided by the number of available years (between 1980-2000 for droughts, 1980-2001 for floods, and 1980 and 2003 for cyclones). Details on the construction of this map can be obtained from Peduzzi, Dao and Herold (2005). The data in grid map format is available from the PREVIEW website at:
http://www.grid.unep.ch/activities/earlywarning/preview/data/preview/index_about.php.

The map of exposure to landslides is based upon the dataset from the Norwegian Geotechnical Institute (NGI). The hazards mapping of NGI incorporates a range of data including slope, soil, soil moisture conditions, precipitation, seismicity, and temperature. Shuttle Radar Topography Mission (SRTM) elevation data at 30-arc-second resolution is incorporated. Hazard values 4 and below are considered negligible and only values from 5–9 are utilized for analysis. To ensure compatibility with other datasets, 1 is added to each of the values to produce a hazard ranking ranging from 6–10. This dataset is the result of the collaboration among the Center for Hazards and Risk Research (CHRR), the Norwegian Geotechnical Institute (NGI), and the Columbia University Center for International Earth Science and Information Network (CIESIN).

*Sea level rise*

The inundation zone map of a five-meter sea level rise was obtained from the Centers for the Remote Sensing of Ice Sheets (CReSIS) at the University of Kansas, USA, and Haskell Indian Nations University, India. Sea level rise or inundation zones were determined from the Global Land One-km Base Elevation (GLOBE) digital elevation model (DEM) (https://www.cresis.ku.edu/research/data/sea_level_rise).

- **Population Density**

The population density map was obtained from the Urban Extent Database (GRUMP version 1) of the Center for International Earth Science Information Network (CIESIN), Columbia University (http://sedac.ciesin.columbia.edu/gpw); the International Food Policy Research Institute (IFPRI); the World Bank; and Centro Internacional de Agricultura Tropical (CIAT). The data is in geographic coordinates of decimal degrees based on the World Geodetic System spheroid of 1984 (WGS84) in 30-arc-second (1-km) resolution.

- **Biodiversity: Areas Declared as National/Protected Parks**

Data on national/protected parks as well as maps were obtained from the Terrestrial Ecoregions GIS Database of the World Wildlife Fund (WWF) at http://www.worldwildlife.org/science/data/item1875.html.

- **Adaptive Capacity**

*Human Development Index*

The Human Development Index (HDI) was calculated using the following formula:

$$\begin{aligned} HDI = \; & (1/3)*[\text{ Standard of Living Index}] \\ + \; & (1/3)*[\text{ Life Expectancy at Birth Index}] \\ + \; & (1/3)*[\text{ Education Index }] \end{aligned}$$

The Standard of Living Index was calculated using the Gross Domestic Regional Product (GDRP) per population (per capita), standardized using Purchasing Power Parity (PPP) for the year 2005. The GDRP data was obtained from different sources, while the PPP exchange rate was obtained from the World Bank's World Development Indicators (WDI).

The Life Expectancy at Birth data was obtained from various sources such as country reports on the Human Development Index of the United Nations Development Program (UNDP).

Education was measured using literacy rates, the data of which was obtained from various sources such as the UNDP's country reports on the HDI.

The index of each of the three components of the HDI was calculated following the methods used by the UNDP.

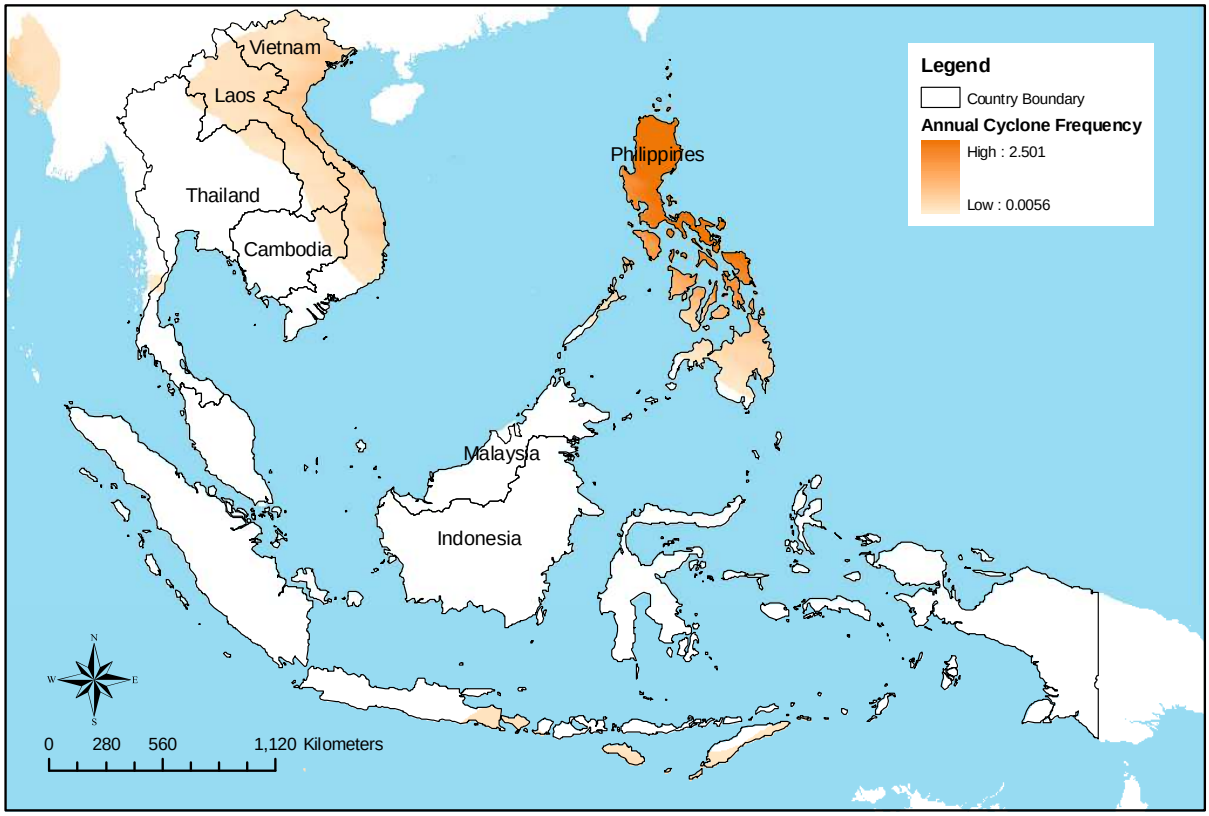
*Poverty incidences and inequality (Gini coefficient)*

Poverty incidences and the Gini coefficients for each of the provinces/districts of Vietnam, Malaysia, Cambodia, the Philippines, and Thailand were obtained from various sources such as the UNDP's country reports on the HDI and the Asian Development Bank (ADB). For Indonesia and Lao PDR, their poverty incidences and Gini coefficients were calculated directly using the Indonesian Socio-economic Survey (SUSENAS) and the Lao Socio-economic Survey (LECS3) data, respectively.

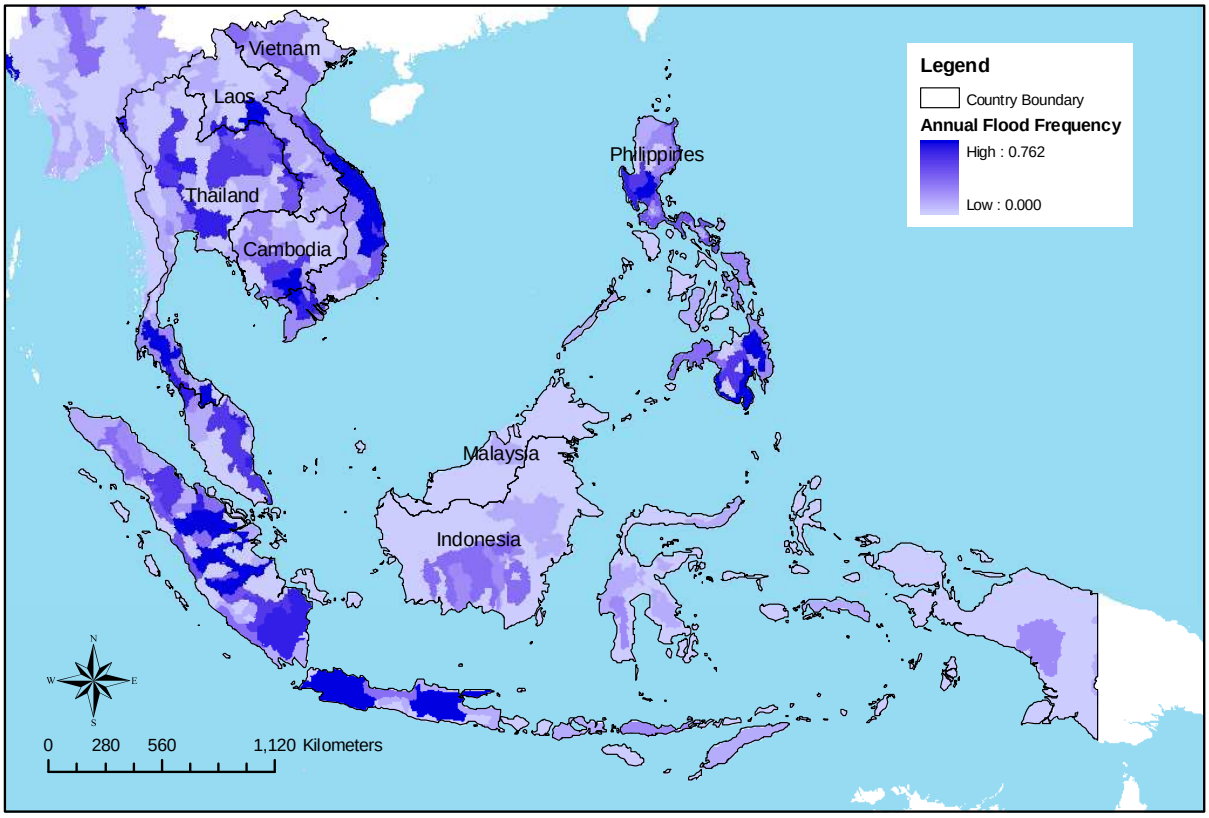
*Technology and infrastructure*

We defined electricity coverage as the percentage of household with access to electricity, and the extent of irrigation as the percentage of irrigated agricultural land. Road density was defined as the length of road per square kilometer. Communication was defined as the number of fixed phone lines per person. The data for all these came from various sources including the websites of the national statistics offices of the different Southeast Asian countries.

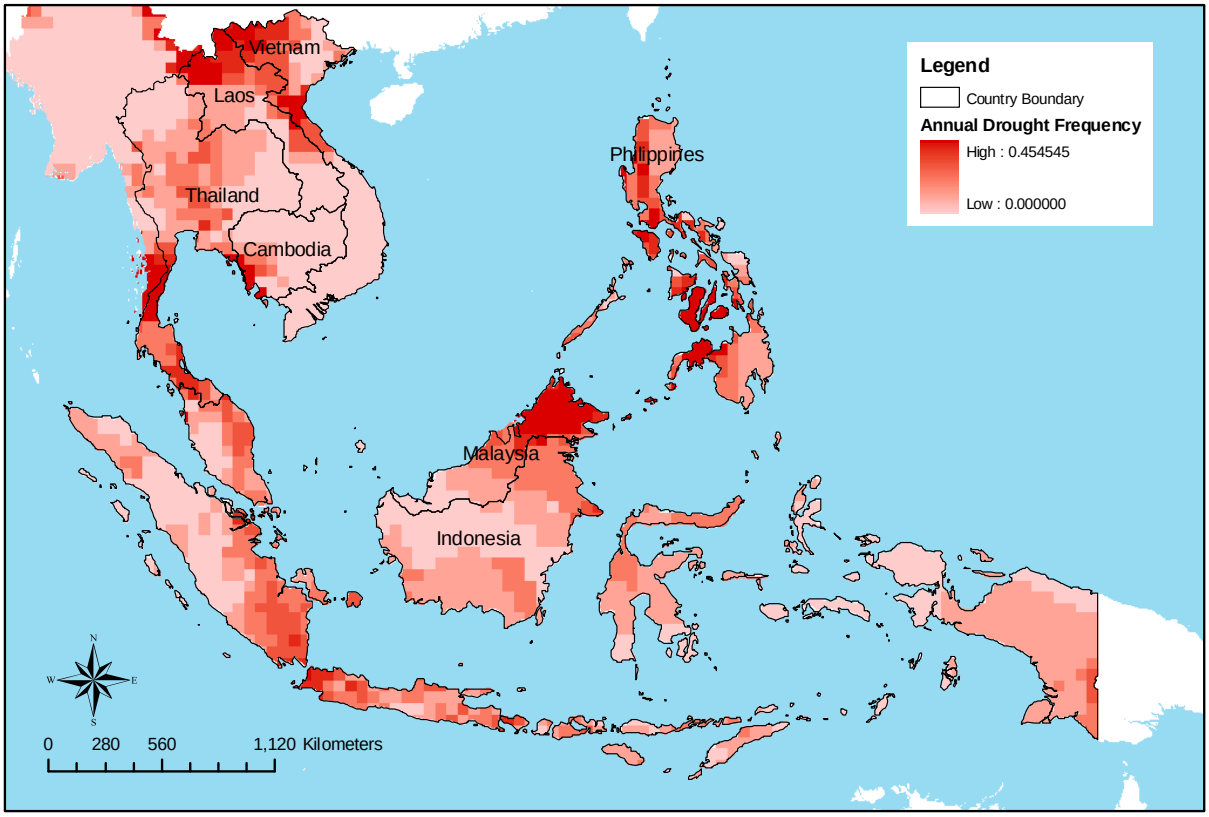
## Appendix 2. Climate Hazard Maps of Southeast Asia



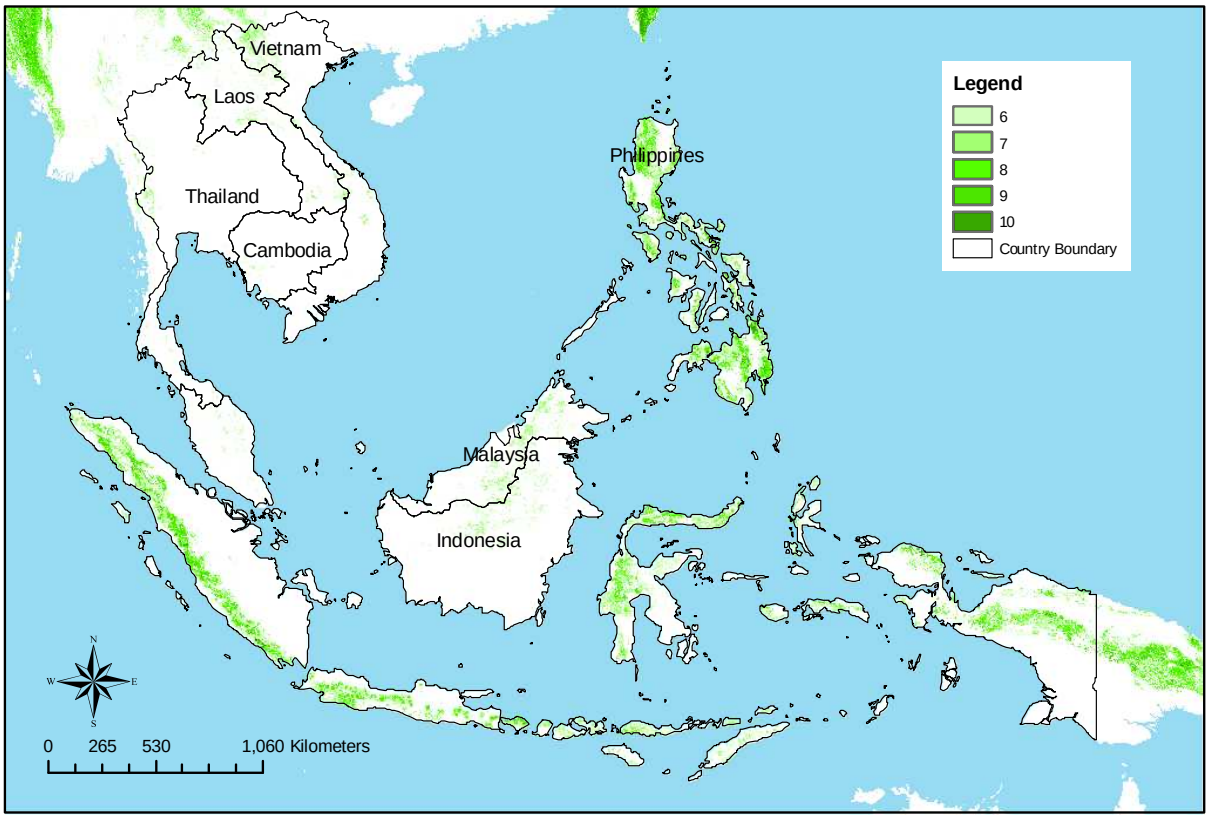

Appendix 2A. Tropical cyclone frequency (event per year from 1980-2003)



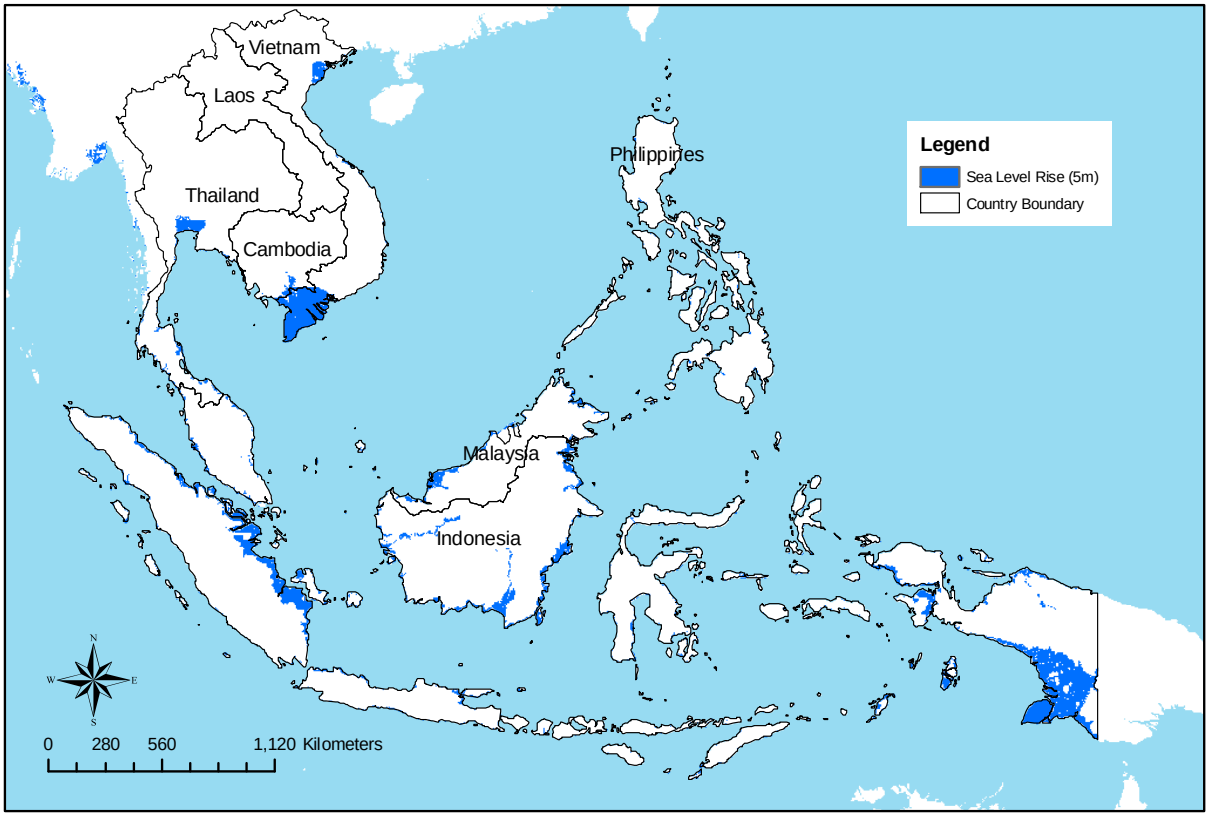

Appendix 2B. Flood frequency (event per year from 1980-2001)




Appendix 2C. Drought frequency (event per year from 1980-2000)




Appendix 2D. Landslide exposure (2005)




Appendix 2E. Sea level rise (5-m inundation zone)

## Appendix 3. List of Vulnerable Provinces/Districts in Southeast Asia

Appendix 3A. List of vulnerable provinces/districts (Southeast Asia standard)

| CON/PROV | VUL | RANK | CHAZ | SENS | ADAP | PDEN | PROT | POP | INC | POV | HDI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAMBODIA** | | | | | | | | | | | |
| **Mondol Kiri** | **0.83** | **4** | **0.02** | **0.37** | **0.99** | **3** | **0.56** | **42** | **1,409** | **52.0** | **0.43** |
| **Rotanokiri** | **0.78** | **6** | **0.05** | **0.25** | **1.00** | **9** | **0.37** | **121** | **1,409** | **52.0** | **0.42** |
| **Kampong Spoe** | **0.67** | **11** | **0.22** | **0.16** | **0.75** | **91** | **0.24** | **730** | **1,029** | **52.0** | **0.51** |
| **Preah Vihear** | **0.64** | **13** | **0.01** | **0.26** | **0.82** | **11** | **0.38** | **152** | **1,409** | **52.0** | **0.49** |
| **Pouthisat** | **0.56** | **24** | **0.17** | **0.27** | **0.50** | **31** | **0.41** | **428** | **1,347** | **42.8** | **0.56** |
| **Takev** | **0.50** | **32** | **0.37** | **0.01** | **0.48** | **254** | **0.00** | **901** | **1,208** | **32.1** | **0.54** |
| **Kandal** | **0.50** | **33** | **0.40** | **0.02** | **0.43** | **428** | **0.00** | **1,243** | **1,304** | **32.1** | **0.55** |
| **Kampot** | **0.49** | **35** | **0.22** | **0.18** | **0.44** | **122** | **0.26** | **603** | **1,714** | **26.8** | **0.53** |
| **Kaoh Kong** | **0.49** | **37** | **0.18** | **0.29** | **0.36** | **10** | **0.44** | **192** | **1,409** | **26.8** | **0.51** |
| **Kampong Chhnang** | **0.47** | **45** | **0.14** | **0.07** | **0.60** | **91** | **0.09** | **513** | **1,258** | **42.8** | **0.52** |
| Prey Veng | 0.45 | 51 | 0.29 | 0.01 | 0.47 | 208 | 0.00 | 1,044 | 1,163 | 32.1 | 0.54 |
| Batdambang | 0.44 | 57 | 0.06 | 0.17 | 0.53 | 75 | 0.25 | 998 | 1,105 | 42.8 | 0.53 |
| Stoeng Treng | 0.43 | 62 | 0.02 | 0.06 | 0.66 | 8 | 0.09 | 104 | 1,409 | 52.0 | 0.51 |
| Siemreab-Otdar M. | 0.43 | 65 | 0.05 | 0.14 | 0.55 | 50 | 0.21 | 861 | 1,230 | 42.8 | 0.53 |
| Kampong Thum | 0.42 | 69 | 0.04 | 0.08 | 0.60 | 49 | 0.12 | 682 | 1,412 | 42.8 | 0.51 |
| Svay Rieng | 0.41 | 73 | 0.23 | 0.01 | 0.47 | 192 | 0.00 | 538 | 948 | 32.1 | 0.54 |
| Kracheh | 0.37 | 92 | 0.01 | 0.04 | 0.61 | 23 | 0.06 | 334 | 1,409 | 52.0 | 0.53 |
| **INDONESIA** | | | | | | | | | | | |
| **Central Jakarta** | **1.00** | **1** | **0.65** | **1.00** | **0.00** | **20,419** | **0.00** | **889** | **21,708** | **3.2** | **0.89** |
| **North Jakarta** | **1.00** | **2** | **1.00** | **0.61** | **0.04** | **12,400** | **0.00** | **1,446** | **9,822** | **6.3** | **0.85** |
| **West Jakarta** | **0.90** | **3** | **0.77** | **0.68** | **0.04** | **9,993** | **0.29** | **2,093** | **7,841** | **2.7** | **0.83** |
| **East Jakarta** | **0.79** | **5** | **0.65** | **0.64** | **0.03** | **13,116** | **0.00** | **2,391** | **5,371** | **3.0** | **0.82** |
| **South Jakarta** | **0.77** | **8** | **0.65** | **0.60** | **0.04** | **12,282** | **0.00** | **2,001** | **8,375** | **3.2** | **0.84** |
| **Kota Bandung** | **0.77** | **9** | **0.58** | **0.65** | **0.06** | **13,298** | **0.00** | **2,289** | **2,374** | **3.7** | **0.75** |
| **Kota Surabaya** | **0.75** | **10** | **0.70** | **0.53** | **0.03** | **10,729** | **0.00** | **2,612** | **5,761** | **7.5** | **0.79** |
| **Kota Bekasi** | **0.65** | **12** | **0.64** | **0.40** | **0.06** | **8,260** | **0.00** | **1,993** | **1,496** | **3.6** | **0.72** |
| **Kota Bogor** | **0.63** | **14** | **0.65** | **0.33** | **0.08** | **6,664** | **0.00** | **891** | **1,017** | **8.9** | **0.70** |
| **Kota Depok** | **0.63** | **15** | **0.65** | **0.34** | **0.07** | **6,959** | **0.00** | **1,375** | **876** | **2.9** | **0.71** |
| **Kota Palembang** | **0.60** | **16** | **0.72** | **0.25** | **0.05** | **5,012** | **0.00** | **1,342** | **2,112** | **9.4** | **0.74** |
| **Kota Tangerang** | **0.60** | **17** | **0.65** | **0.33** | **0.04** | **6,638** | **0.00** | **1,452** | **3,679** | **4.7** | **0.76** |
| **Tangerang** | **0.60** | **18** | **0.78** | **0.13** | **0.10** | **2,459** | **0.02** | **3,259** | **1,262** | **7.7** | **0.68** |
| **West Lampung** | **0.60** | **19** | **0.45** | **0.39** | **0.18** | **74** | **0.58** | **378** | **833** | **25.6** | **0.65** |
| **Jayawijaya** | **0.58** | **20** | **0.20** | **0.23** | **0.56** | **7** | **0.34** | **210** | **677** | **50.3** | **0.44** |
| **Kota Malang** | **0.58** | **21** | **0.49** | **0.45** | **0.05** | **9,106** | **0.00** | **790** | **3,211** | **6.9** | **0.75** |
| **Puncak Jaya** | **0.57** | **22** | **0.20** | **0.27** | **0.49** | **6** | **0.41** | **111** | **520** | **53.8** | **0.61** |
| **Jembrana** | **0.56** | **23** | **0.48** | **0.38** | **0.08** | **299** | **0.55** | **247** | **1,414** | **9.3** | **0.69** |
| **Bogor*** | **0.55** | **25** | **0.72** | **0.11** | **0.09** | **1,366** | **0.07** | **3,829** | **1,562** | **12.4** | **0.70** |
| **Garut** | **0.53** | **26** | **0.73** | **0.07** | **0.11** | **678** | **0.06** | **2,196** | **1,015** | **17.6** | **0.67** |
| **Lebak** | **0.51** | **28** | **0.69** | **0.06** | **0.12** | **356** | **0.06** | **1,155** | **724** | **12.2** | **0.63** |
| **Bandung** | **0.50** | **29** | **0.69** | **0.09** | **0.08** | **1,438** | **0.03** | **4,037** | **1,302** | **13.6** | **0.71** |
| **Sumedang** | **0.50** | **31** | **0.69** | **0.08** | **0.09** | **692** | **0.07** | **1,014** | **1,189** | **13.6** | **0.69** |
| **Sukabumi** | **0.49** | **39** | **0.62** | **0.11** | **0.11** | **567** | **0.12** | **2,169** | **936** | **16.8** | **0.67** |
| **Cianjur** | **0.48** | **41** | **0.64** | **0.07** | **0.11** | **568** | **0.06** | **2,080** | **834** | **17.8** | **0.66** |
| Buleleng | 0.46 | 47 | 0.50 | 0.19 | 0.10 | 437 | 0.26 | 600 | 1,106 | 9.3 | 0.67 |
| Pandeglang | 0.46 | 48 | 0.52 | 0.16 | 0.11 | 455 | 0.20 | 1,063 | 805 | 14.6 | 0.64 |
| Tanjung Jabung | 0.45 | 49 | 0.47 | 0.18 | 0.13 | 43 | 0.27 | 204 | 1,081 | 13.6 | 0.68 |
| Karawang | 0.45 | 50 | 0.63 | 0.05 | 0.11 | 983 | 0.00 | 1,926 | 1,661 | 14.8 | 0.67 |

| CON/PROV | VUL | RANK | CHAZ | SENS | ADAP | PDEN | PROT | POP | INC | POV | HDI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South East Aceh | 0.45 | 53 | 0.33 | 0.34 | 0.10 | 20 | 0.50 | 168 | 1,002 | 25.3 | 0.70 |
| Kota Balikpapan | 0.45 | 54 | 0.40 | 0.31 | 0.06 | 468 | 0.44 | 470 | 3,939 | 3.7 | 0.79 |
| Bekasi | 0.45 | 55 | 0.62 | 0.09 | 0.06 | 1,891 | 0.00 | 1,984 | 5,058 | 6.9 | 0.77 |
| Paniai* | 0.44 | 56 | 0.26 | 0.14 | 0.36 | 10 | 0.21 | 114 | 596 | 51.8 | 0.54 |
| South Bengkulu | 0.43 | 58 | 0.37 | 0.21 | 0.17 | 56 | 0.30 | 130 | 855 | 38.0 | 0.67 |
| Bangkalan | 0.43 | 59 | 0.52 | 0.03 | 0.19 | 618 | 0.00 | 890 | 769 | 32.2 | 0.57 |
| Purwakarta | 0.43 | 61 | 0.60 | 0.05 | 0.09 | 731 | 0.03 | 753 | 1,790 | 14.7 | 0.70 |
| Sidoarjo | 0.43 | 63 | 0.51 | 0.16 | 0.07 | 3,321 | 0.00 | 1,697 | 3,100 | 14.1 | 0.76 |
| Tanggamus | 0.42 | 67 | 0.49 | 0.10 | 0.15 | 216 | 0.13 | 821 | 865 | 20.4 | 0.66 |
| Majalengka | 0.42 | 68 | 0.57 | 0.04 | 0.12 | 848 | 0.00 | 1,168 | 725 | 19.5 | 0.64 |
| Ponorogo | 0.41 | 72 | 0.54 | 0.04 | 0.13 | 608 | 0.02 | 870 | 751 | 17.3 | 0.62 |
| Kota Blitar | 0.40 | 78 | 0.49 | 0.13 | 0.08 | 2,587 | 0.00 | 127 | 1,187 | 11.2 | 0.71 |
| Tasik Malaya | 0.39 | 79 | 0.54 | 0.03 | 0.11 | 682 | 0.00 | 1,619 | 679 | 18.3 | 0.67 |
| South Aceh* | 0.39 | 80 | 0.29 | 0.28 | 0.11 | 30 | 0.41 | 189 | 1,572 | 27.7 | 0.70 |
| Kota Madiun | 0.39 | 81 | 0.47 | 0.13 | 0.07 | 2,724 | 0.00 | 171 | 1,322 | 9.2 | 0.71 |
| Serang* | 0.38 | 84 | 0.46 | 0.09 | 0.12 | 945 | 0.07 | 1,755 | 1,154 | 11.2 | 0.65 |
| Dairi | 0.38 | 88 | 0.48 | 0.07 | 0.11 | 99 | 0.10 | 265 | 1,567 | 19.6 | 0.70 |
| Gorontalo* | 0.37 | 91 | 0.30 | 0.15 | 0.20 | 100 | 0.22 | 422 | 465 | 32.8 | 0.63 |
| Sampang | 0.37 | 93 | 0.39 | 0.03 | 0.23 | 604 | 0.00 | 835 | 636 | 39.0 | 0.50 |
| Magetan | 0.37 | 94 | 0.51 | 0.04 | 0.10 | 833 | 0.00 | 617 | 1,031 | 16.9 | 0.68 |
| Indramayu | 0.37 | 97 | 0.46 | 0.04 | 0.14 | 916 | 0.00 | 1,689 | 873 | 18.5 | 0.60 |
| Ciamis | 0.37 | 98 | 0.49 | 0.05 | 0.10 | 573 | 0.03 | 1,512 | 969 | 15.1 | 0.68 |
| Madiun | 0.37 | 100 | 0.49 | 0.04 | 0.12 | 737 | 0.00 | 642 | 851 | 21.4 | 0.63 |
| Lahat | 0.36 | 101 | 0.31 | 0.18 | 0.14 | 98 | 0.27 | 547 | 1,174 | 29.7 | 0.69 |
| East Lombok | 0.36 | 102 | 0.23 | 0.19 | 0.21 | 675 | 0.24 | 1,039 | 563 | 28.4 | 0.54 |
| Ogan Komering Hilir | 0.36 | 104 | 0.47 | 0.01 | 0.15 | 56 | 0.01 | 660 | 964 | 24.5 | 0.67 |
| Kota Bitung | 0.36 | 106 | 0.33 | 0.24 | 0.06 | 283 | 0.33 | 164 | 2,557 | 9.2 | 0.76 |
| Indragiri Hilir | 0.36 | 107 | 0.48 | 0.02 | 0.13 | 45 | 0.03 | 631 | 1,876 | 16.9 | 0.74 |
| Malang | 0.35 | 108 | 0.44 | 0.07 | 0.11 | 776 | 0.05 | 2,336 | 1,194 | 16.0 | 0.65 |
| Subang | 0.35 | 109 | 0.48 | 0.04 | 0.10 | 699 | 0.01 | 1,380 | 981 | 16.9 | 0.66 |
| Trenggalek | 0.35 | 110 | 0.47 | 0.03 | 0.12 | 539 | 0.00 | 665 | 662 | 22.9 | 0.66 |
| Kota Banjarmasin | 0.35 | 111 | 0.51 | 0.06 | 0.05 | 1,248 | 0.00 | 589 | 1,539 | 2.9 | 0.70 |
| Merauke | 0.35 | 112 | 0.37 | 0.09 | 0.16 | 2 | 0.13 | 156 | 1,834 | 33.9 | 0.65 |
| West Sumba | 0.35 | 113 | 0.10 | 0.03 | 0.48 | 96 | 0.05 | 400 | 382 | 42.1 | 0.53 |
| Nganjuk | 0.35 | 115 | 0.46 | 0.03 | 0.12 | 703 | 0.00 | 990 | 949 | 23.8 | 0.65 |
| Kediri | 0.35 | 117 | 0.45 | 0.05 | 0.11 | 953 | 0.00 | 1,429 | 860 | 17.9 | 0.66 |
| Lamongan | 0.35 | 118 | 0.46 | 0.03 | 0.12 | 706 | 0.00 | 1,187 | 830 | 23.7 | 0.64 |
| Kota Kediri | 0.34 | 120 | 0.43 | 0.17 | 0.01 | 3,457 | 0.00 | 249 | 18,983 | 13.5 | 0.86 |
| Manggarai | 0.34 | 122 | 0.27 | 0.07 | 0.26 | 99 | 0.10 | 484 | 396 | 32.1 | 0.61 |
| Boyolali | 0.34 | 123 | 0.36 | 0.13 | 0.11 | 844 | 0.13 | 923 | 952 | 17.5 | 0.66 |
| Ngawi | 0.34 | 124 | 0.44 | 0.03 | 0.13 | 592 | 0.00 | 828 | 727 | 23.4 | 0.62 |
| Agam | 0.34 | 125 | 0.39 | 0.11 | 0.10 | 189 | 0.15 | 425 | 1,391 | 13.2 | 0.71 |
| Langkat | 0.34 | 126 | 0.27 | 0.23 | 0.10 | 160 | 0.33 | 996 | 1,326 | 20.8 | 0.71 |
| Jombang | 0.34 | 128 | 0.43 | 0.06 | 0.11 | 1,142 | 0.00 | 1,222 | 991 | 22.8 | 0.67 |
| Ogan Komering Ulu | 0.33 | 129 | 0.38 | 0.11 | 0.10 | 112 | 0.15 | 255 | 1,673 | 17.7 | 0.72 |
| Padang Pariaman* | 0.33 | 130 | 0.42 | 0.06 | 0.10 | 295 | 0.07 | 378 | 1,325 | 14.2 | 0.69 |
| Bojonegoro | 0.33 | 131 | 0.43 | 0.02 | 0.13 | 482 | 0.00 | 1,229 | 921 | 26.4 | 0.63 |
| Kota Padang | 0.33 | 132 | 0.45 | 0.07 | 0.06 | 1,511 | 0.00 | 800 | 2,895 | 4.3 | 0.77 |

| CON/PROV | VUL | RANK | CHAZ | SENS | ADAP | PDEN | PROT | POP | INC | POV | HDI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LAO PDR** | | | | | | | | | | | |
| **Phongsali** | **0.49** | **38** | **0.28** | **0.09** | **0.47** | **12** | **0.13** | **166** | **973** | **44.3** | **0.48** |
| **Houaphan** | **0.48** | **42** | **0.22** | **0.17** | **0.43** | **18** | **0.25** | **281** | **1,113** | **45.4** | **0.50** |
| Louang Namtha | 0.45 | 52 | 0.38 | 0.06 | 0.33 | 14 | 0.10 | 145 | 1,511 | 20.2 | 0.49 |
| Oudomxai | 0.42 | 66 | 0.30 | 0.00 | 0.44 | 19 | 0.00 | 265 | 962 | 42.5 | 0.50 |
| Saravan | 0.40 | 76 | 0.10 | 0.17 | 0.44 | 30 | 0.25 | 324 | 919 | 47.6 | 0.47 |
| Khammouan | 0.40 | 77 | 0.18 | 0.29 | 0.23 | 21 | 0.43 | 337 | 1,496 | 32.4 | 0.56 |
| Bokeo | 0.35 | 114 | 0.32 | 0.01 | 0.29 | 18 | 0.02 | 145 | 1,238 | 21.1 | 0.52 |
| Attapeu | 0.34 | 121 | 0.07 | 0.15 | 0.38 | 14 | 0.23 | 112 | 1,333 | 40.6 | 0.57 |
| **PHILIPPINES** | | | | | | | | | | | |
| **National Capital Region** | **0.78** | **7** | **0.54** | **0.71** | **0.05** | **14,495** | **0.00** | **11,600** | **6,205** | **4.3** | **0.81** |
| **Cordillera Adm. Region** | **0.51** | **27** | **0.70** | **0.05** | **0.13** | **78** | **0.07** | **1,521** | **3,111** | **14.5** | **0.71** |
| **Central Luzon** | **0.50** | **30** | **0.67** | **0.11** | **0.09** | **541** | **0.12** | **9,721** | **1,934** | **13.4** | **0.73** |
| **Cagayan Valley** | **0.50** | **34** | **0.56** | **0.13** | **0.16** | **110** | **0.18** | **3,051** | **1,328** | **26.8** | **0.68** |
| **Bicol** | **0.49** | **36** | **0.59** | **0.04** | **0.21** | **255** | **0.04** | **5,110** | **1,151** | **43.6** | **0.69** |
| **Ilocos** | **0.49** | **40** | **0.69** | **0.03** | **0.11** | **335** | **0.02** | **4,546** | **1,342** | **16.5** | **0.71** |
| **Southern Tagalog** | **0.47** | **44** | **0.50** | **0.22** | **0.09** | **319** | **0.31** | **14,300** | **4,669** | **14.9** | **0.76** |
| Eastern Visayas | 0.43 | 60 | 0.48 | 0.01 | 0.25 | 163 | 0.01 | 3,913 | 1,159 | 45.4 | 0.65 |
| Northern Mindanao | 0.41 | 74 | 0.48 | 0.05 | 0.17 | 148 | 0.07 | 3,952 | 2,575 | 33.7 | 0.71 |
| Central Visayas | 0.38 | 86 | 0.45 | 0.05 | 0.17 | 388 | 0.04 | 6,399 | 2,347 | 37.3 | 0.72 |
| Western Mindanao | 0.38 | 87 | 0.43 | 0.02 | 0.21 | 207 | 0.01 | 3,230 | 1,764 | 39.8 | 0.65 |
| Western Visayas | 0.37 | 96 | 0.43 | 0.06 | 0.16 | 299 | 0.07 | 6,844 | 2,227 | 26.4 | 0.71 |
| Southern Mindanao | 0.36 | 103 | 0.47 | 0.04 | 0.13 | 174 | 0.04 | 4,157 | 2,412 | 22.5 | 0.72 |
| Central Mindanao | 0.36 | 105 | 0.41 | 0.04 | 0.18 | 186 | 0.04 | 3,829 | 1,993 | 28.0 | 0.67 |
| **THAILAND** | | | | | | | | | | | |
| **Krung Thep** | **0.47** | **43** | **0.61** | **0.20** | **0.00** | **4,162** | **0.00** | **1,232** | **18,710** | **0.5** | **0.88** |
| Samut Prakan | 0.41 | 75 | 0.59 | 0.09 | 0.03 | 1,853 | 0.00 | 1,078 | 24,321 | 9.8 | 0.89 |
| Nonthaburi | 0.39 | 82 | 0.59 | 0.05 | 0.03 | 1,061 | 0.00 | 896 | 5,236 | 0.3 | 0.80 |
| Trang | 0.34 | 119 | 0.41 | 0.14 | 0.06 | 123 | 0.20 | 602 | 4,781 | 0.7 | 0.80 |
| Samut Sakhon | 0.34 | 127 | 0.54 | 0.03 | 0.03 | 538 | 0.00 | 452 | 31,051 | 0.8 | 0.90 |
| **VIETNAM** | | | | | | | | | | | |
| **Lai Chau** | **0.47** | **46** | **0.42** | **0.15** | **0.23** | **33** | **0.22** | **506** | **1,313** | **41.0** | **0.43** |
| **Dong Thap** | **0.43** | **64** | **0.65** | **0.03** | **0.06** | **498** | **0.01** | **1,494** | **2,975** | **19.3** | **0.72** |
| Vinh Long | 0.42 | 70 | 0.64 | 0.03 | 0.05 | 586 | 0.00 | 1,066 | 1,903 | 16.5 | 0.74 |
| Can Tho | 0.41 | 71 | 0.64 | 0.03 | 0.05 | 578 | 0.00 | 1,814 | 2,123 | 14.9 | 0.72 |
| Tra Vinh | 0.38 | 83 | 0.55 | 0.02 | 0.10 | 443 | 0.00 | 958 | 1,841 | 30.7 | 0.68 |
| An Giang | 0.38 | 85 | 0.57 | 0.04 | 0.05 | 604 | 0.02 | 1,976 | 2,084 | 13.6 | 0.69 |
| Tien Giang | 0.38 | 89 | 0.59 | 0.04 | 0.04 | 748 | 0.00 | 1,657 | 1,839 | 17.4 | 0.73 |
| Soc Trang | 0.38 | 90 | 0.54 | 0.02 | 0.10 | 372 | 0.00 | 1,194 | 1,393 | 29.8 | 0.68 |
| Ben Tre | 0.37 | 95 | 0.55 | 0.03 | 0.07 | 650 | 0.00 | 1,340 | 1,663 | 31.7 | 0.72 |
| Thai Binh | 0.37 | 99 | 0.57 | 0.06 | 0.02 | 1,179 | 0.00 | 1,813 | 1,493 | 9.9 | 0.77 |
| Minh Hai | 0.35 | 116 | 0.52 | 0.05 | 0.05 | 267 | 0.05 | 1,752 | 2,034 | 21.4 | 0.72 |

Notes:

1. VUL: Climate change vulnerability index; RANK: Rank of climate change vulnerability index (across SEA); CHAZ: Multiple climate hazard index; SENS: Sensitivity index; ADAP: Index of inverse adaptive capacity; PDEN: Population density in 2000 (population/km$^2$); PROT: Protected area (% of total area); POP: population (thousand); INC: per capita income in 2005 (US$PPP); POV: Poverty incidence; HDI: Human Development Index.
2. Color coding: High vulnerability: red bold; moderate vulnerability: black bold; mild vulnerability: black.

Appendix 3B. List of vulnerable provinces/districts (country standard)

| PROV | VUL | RNK | CHAZ | SENS | ADAP | PDEN | PROT | POP | INC | POV | HDI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAMBODIA** | | | | | | | | | | | |
| **Mondol Kiri** | **0.83** | **1** | **0.02** | **0.37** | **0.99** | **3** | **0.56** | **42** | **1,409** | **52.0** | **0.43** |
| **Rotanokiri** | **0.78** | **2** | **0.05** | **0.25** | **1.00** | **9** | **0.37** | **121** | **1,409** | **52.0** | **0.42** |
| **Kampong Spoe** | **0.67** | **3** | **0.22** | **0.16** | **0.75** | **91** | **0.24** | **730** | **1,029** | **52.0** | **0.51** |
| **Preah Vihear** | **0.64** | **4** | **0.01** | **0.26** | **0.82** | **11** | **0.38** | **152** | **1,409** | **52.0** | **0.49** |
| **JAKARTA** | | | | | | | | | | | |
| **Central Jakarta** | **1.00** | **1** | **0.65** | **1.00** | **0.00** | **20,419** | **0.00** | **889** | **21,708** | **3.2** | **0.89** |
| **North Jakarta** | **1.00** | **2** | **1.00** | **0.61** | **0.04** | **12,400** | **0.00** | **1446** | **9,822** | **6.3** | **0.85** |
| **West Jakarta** | **0.90** | **3** | **0.77** | **0.68** | **0.04** | **9,993** | **0.29** | **2093** | **7,841** | **2.7** | **0.83** |
| **East Jakarta** | **0.79** | **4** | **0.65** | **0.64** | **0.03** | **13,116** | **0.00** | **2391** | **5,371** | **3.0** | **0.82** |
| **South Jakarta** | **0.77** | **5** | **0.65** | **0.60** | **0.04** | **12,282** | **0.00** | **2001** | **8,375** | **3.2** | **0.84** |
| **Kota Bandung** | **0.77** | **6** | **0.58** | **0.65** | **0.06** | **13,298** | **0.00** | **2289** | **2,374** | **3.7** | **0.75** |
| **Kota Surabaya** | **0.75** | **7** | **0.70** | **0.53** | **0.03** | **10,729** | **0.00** | **2612** | **5,761** | **7.5** | **0.79** |
| **Kota Bekasi** | **0.65** | **8** | **0.64** | **0.40** | **0.06** | **8,260** | **0.00** | **1993** | **1,496** | **3.6** | **0.72** |
| **Kota Bogor** | **0.63** | **9** | **0.65** | **0.33** | **0.08** | **6,664** | **0.00** | **891** | **1,017** | **8.9** | **0.70** |
| **Kota Depok** | **0.63** | **10** | **0.65** | **0.34** | **0.07** | **6,959** | **0.00** | **1375** | **876** | **2.9** | **0.71** |
| **Kota Palembang** | **0.60** | **11** | **0.72** | **0.25** | **0.05** | **5,012** | **0.00** | **1342** | **2,112** | **9.4** | **0.74** |
| **Kota Tangerang** | **0.60** | **12** | **0.65** | **0.33** | **0.04** | **6,638** | **0.00** | **1452** | **3,679** | **4.7** | **0.76** |
| **Tangerang** | **0.60** | **13** | **0.78** | **0.13** | **0.10** | **2,459** | **0.02** | **3259** | **1,262** | **7.7** | **0.68** |
| **West Lampung** | **0.60** | **14** | **0.45** | **0.39** | **0.18** | **74** | **0.58** | **378** | **833** | **25.6** | **0.65** |
| **Jayawijaya** | **0.58** | **15** | **0.20** | **0.23** | **0.56** | **7** | **0.34** | **210** | **677** | **50.3** | **0.44** |
| **Kota Malang** | **0.58** | **16** | **0.49** | **0.45** | **0.05** | **9,106** | **0.00** | **790** | **3,211** | **6.9** | **0.75** |
| **Puncak Jaya** | **0.57** | **17** | **0.20** | **0.27** | **0.49** | **6** | **0.41** | **111** | **520** | **53.8** | **0.61** |
| **Jembrana** | **0.56** | **18** | **0.48** | **0.38** | **0.08** | **299** | **0.55** | **247** | **1,414** | **9.3** | **0.69** |
| **Bogor*** | **0.55** | **19** | **0.72** | **0.11** | **0.09** | **1,366** | **0.07** | **3829** | **1,562** | **12.4** | **0.70** |
| **Garut** | **0.53** | **20** | **0.73** | **0.07** | **0.11** | **678** | **0.06** | **2196** | **1,015** | **17.6** | **0.67** |
| **Lebak** | **0.51** | **21** | **0.69** | **0.06** | **0.12** | **356** | **0.06** | **1155** | **724** | **12.2** | **0.63** |
| **Bandung** | **0.50** | **22** | **0.69** | **0.09** | **0.08** | **1,438** | **0.03** | **4037** | **1,302** | **13.6** | **0.71** |
| **Sumedang** | **0.50** | **23** | **0.69** | **0.08** | **0.09** | **692** | **0.07** | **1014** | **1,189** | **13.6** | **0.69** |
| **Sukabumi** | **0.49** | **24** | **0.62** | **0.11** | **0.11** | **567** | **0.12** | **2169** | **936** | **16.8** | **0.67** |
| **Cianjur** | **0.48** | **25** | **0.64** | **0.07** | **0.11** | **568** | **0.06** | **2080** | **834** | **17.8** | **0.66** |
| **Buleleng** | **0.46** | **26** | **0.50** | **0.19** | **0.10** | **437** | **0.26** | **600** | **1,106** | **9.3** | **0.67** |
| **Pandeglang** | **0.46** | **27** | **0.52** | **0.16** | **0.11** | **455** | **0.20** | **1063** | **805** | **14.6** | **0.64** |
| **Tanjung Jabung** | **0.45** | **28** | **0.47** | **0.18** | **0.13** | **43** | **0.27** | **204** | **1,081** | **13.6** | **0.68** |
| **Karawang** | **0.45** | **29** | **0.63** | **0.05** | **0.11** | **983** | **0.00** | **1926** | **1,661** | **14.8** | **0.67** |
| **South East Aceh** | **0.45** | **30** | **0.33** | **0.34** | **0.10** | **20** | **0.50** | **168** | **1,002** | **25.3** | **0.70** |
| **Kota Balikpapan** | **0.45** | **31** | **0.40** | **0.31** | **0.06** | **468** | **0.44** | **470** | **3,939** | **3.7** | **0.79** |
| **Bekasi** | **0.45** | **32** | **0.62** | **0.09** | **0.06** | **1,891** | **0.00** | **1984** | **5,058** | **6.9** | **0.77** |
| **Paniai*** | **0.44** | **33** | **0.26** | **0.14** | **0.36** | **10** | **0.21** | **114** | **596** | **51.8** | **0.54** |
| South Bengkulu | 0.43 | 34 | 0.37 | 0.21 | 0.17 | 56 | 0.30 | 130 | 855 | 38.0 | 0.67 |
| Bangkalan | 0.43 | 35 | 0.52 | 0.03 | 0.19 | 618 | 0.00 | 890 | 769 | 32.2 | 0.57 |
| Purwakarta | 0.43 | 36 | 0.60 | 0.05 | 0.09 | 731 | 0.03 | 753 | 1,790 | 14.7 | 0.70 |
| Sidoarjo | 0.43 | 37 | 0.51 | 0.16 | 0.07 | 3,321 | 0.00 | 1697 | 3,100 | 14.1 | 0.76 |
| Tanggamus | 0.42 | 38 | 0.49 | 0.10 | 0.15 | 216 | 0.13 | 821 | 865 | 20.4 | 0.66 |
| Majalengka | 0.42 | 39 | 0.57 | 0.04 | 0.12 | 848 | 0.00 | 1168 | 725 | 19.5 | 0.64 |
| Ponorogo | 0.41 | 40 | 0.54 | 0.04 | 0.13 | 608 | 0.02 | 870 | 751 | 17.3 | 0.62 |
| Kota Blitar | 0.40 | 41 | 0.49 | 0.13 | 0.08 | 2,587 | 0.00 | 127 | 1,187 | 11.2 | 0.71 |

| PROV | VUL | RNK | CHAZ | SENS | ADAP | PDEN | PROT | POP | INC | POV | HDI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tasik Malaya | **0.39** | **42** | **0.54** | **0.03** | **0.11** | **682** | **0.00** | **1619** | **679** | **18.3** | **0.67** |
| South Aceh* | 0.39 | 43 | 0.29 | 0.28 | 0.11 | 30 | 0.41 | 189 | 1,572 | 27.7 | 0.70 |
| Kota Madiun | 0.39 | 44 | 0.47 | 0.13 | 0.07 | 2,724 | 0.00 | 171 | 1,322 | 9.2 | 0.71 |
| Serang* | 0.38 | 45 | 0.46 | 0.09 | 0.12 | 945 | 0.07 | 1755 | 1,154 | 11.2 | 0.65 |
| Dairi | 0.38 | 46 | 0.48 | 0.07 | 0.11 | 99 | 0.10 | 265 | 1,567 | 19.6 | 0.70 |
| Gorontalo* | 0.37 | 47 | 0.30 | 0.15 | 0.20 | 100 | 0.22 | 422 | 465 | 32.8 | 0.63 |
| Sampang | 0.37 | 48 | 0.39 | 0.03 | 0.23 | 604 | 0.00 | 835 | 636 | 39.0 | 0.50 |
| Magetan | 0.37 | 49 | 0.51 | 0.04 | 0.10 | 833 | 0.00 | 617 | 1,031 | 16.9 | 0.68 |
| Indramayu | 0.37 | 50 | 0.46 | 0.04 | 0.14 | 916 | 0.00 | 1689 | 873 | 18.5 | 0.60 |
| Ciamis | 0.37 | 51 | 0.49 | 0.05 | 0.10 | 573 | 0.03 | 1512 | 969 | 15.1 | 0.68 |
| Madiun | 0.37 | 52 | 0.49 | 0.04 | 0.12 | 737 | 0.00 | 642 | 851 | 21.4 | 0.63 |
| Lahat | 0.36 | 53 | 0.31 | 0.18 | 0.14 | 98 | 0.27 | 547 | 1,174 | 29.7 | 0.69 |
| East Lombok | 0.36 | 54 | 0.23 | 0.19 | 0.21 | 675 | 0.24 | 1039 | 563 | 28.4 | 0.54 |
| Ogan Komering Hilir | 0.36 | 55 | 0.47 | 0.01 | 0.15 | 56 | 0.01 | 660 | 964 | 24.5 | 0.67 |
| Kota Bitung | 0.36 | 56 | 0.33 | 0.24 | 0.06 | 283 | 0.33 | 164 | 2,557 | 9.2 | 0.76 |
| Indragiri Hilir | 0.36 | 57 | 0.48 | 0.02 | 0.13 | 45 | 0.03 | 631 | 1,876 | 16.9 | 0.74 |
| Malang | 0.35 | 58 | 0.44 | 0.07 | 0.11 | 776 | 0.05 | 2336 | 1,194 | 16.0 | 0.65 |
| Subang | 0.35 | 59 | 0.48 | 0.04 | 0.10 | 699 | 0.01 | 1380 | 981 | 16.9 | 0.66 |
| Trenggalek | 0.35 | 60 | 0.47 | 0.03 | 0.12 | 539 | 0.00 | 665 | 662 | 22.9 | 0.66 |
| Kota Banjarmasin | 0.35 | 61 | 0.51 | 0.06 | 0.05 | 1,248 | 0.00 | 589 | 1,539 | 2.9 | 0.70 |
| Merauke | 0.35 | 62 | 0.37 | 0.09 | 0.16 | 2 | 0.13 | 156 | 1,834 | 33.9 | 0.65 |
| West Sumba | 0.35 | 63 | 0.10 | 0.03 | 0.48 | 96 | 0.05 | 400 | 382 | 42.1 | 0.53 |
| Nganjuk | 0.35 | 64 | 0.46 | 0.03 | 0.12 | 703 | 0.00 | 990 | 949 | 23.8 | 0.65 |
| Kediri | 0.35 | 65 | 0.45 | 0.05 | 0.11 | 953 | 0.00 | 1429 | 860 | 17.9 | 0.66 |
| Lamongan | 0.35 | 66 | 0.46 | 0.03 | 0.12 | 706 | 0.00 | 1187 | 830 | 23.7 | 0.64 |
| Kota Kediri | 0.34 | 67 | 0.43 | 0.17 | 0.01 | 3,457 | 0.00 | 249 | 18,983 | 13.5 | 0.86 |
| Manggarai | 0.34 | 68 | 0.27 | 0.07 | 0.26 | 99 | 0.10 | 484 | 396 | 32.1 | 0.61 |
| Boyolali | 0.34 | 69 | 0.36 | 0.13 | 0.11 | 844 | 0.13 | 923 | 952 | 17.5 | 0.66 |
| Ngawi | 0.34 | 70 | 0.44 | 0.03 | 0.13 | 592 | 0.00 | 828 | 727 | 23.4 | 0.62 |
| Agam | 0.34 | 71 | 0.39 | 0.11 | 0.10 | 189 | 0.15 | 425 | 1,391 | 13.2 | 0.71 |
| Langkat | 0.34 | 72 | 0.27 | 0.23 | 0.10 | 160 | 0.33 | 996 | 1,326 | 20.8 | 0.71 |
| Jombang | 0.34 | 73 | 0.43 | 0.06 | 0.11 | 1,142 | 0.00 | 1222 | 991 | 22.8 | 0.67 |
| Ogan Komering Ulu | 0.33 | 74 | 0.38 | 0.11 | 0.10 | 112 | 0.15 | 255 | 1,673 | 17.7 | 0.72 |
| Padang Pariaman* | 0.33 | 75 | 0.42 | 0.06 | 0.10 | 295 | 0.07 | 378 | 1,325 | 14.2 | 0.69 |
| Bojonegoro | 0.33 | 76 | 0.43 | 0.02 | 0.13 | 482 | 0.00 | 1229 | 921 | 26.4 | 0.63 |
| Kota Padang | 0.33 | 77 | 0.45 | 0.07 | 0.06 | 1,511 | 0.00 | 800 | 2,895 | 4.3 | 0.77 |
| Sumenep | 0.33 | 78 | 0.39 | 0.02 | 0.17 | 483 | 0.00 | 1005 | 1,027 | 33.0 | 0.59 |
| Pamekasan | 0.33 | 79 | 0.38 | 0.04 | 0.15 | 881 | 0.00 | 763 | 537 | 31.1 | 0.57 |
| Tabanan | 0.33 | 80 | 0.40 | 0.10 | 0.08 | 400 | 0.12 | 398 | 1,210 | 9.3 | 0.71 |
| Temanggung | 0.32 | 81 | 0.42 | 0.04 | 0.11 | 900 | 0.00 | 688 | 737 | 14.7 | 0.68 |
| Blitar | 0.32 | 82 | 0.43 | 0.04 | 0.11 | 727 | 0.00 | 1066 | 1,056 | 16.5 | 0.67 |
| Kota Padang Panjang | 0.32 | 83 | 0.47 | 0.04 | 0.06 | 921 | 0.00 | 45 | 1,741 | 4.4 | 0.74 |
| Bangli | 0.32 | 84 | 0.47 | 0.02 | 0.09 | 423 | 0.00 | 209 | 1,059 | 6.8 | 0.66 |
| **LAO PDR** | | | | | | | | | | | |
| **Phongsali** | **0.49** | **1** | **0.28** | **0.09** | **0.47** | **12** | **0.13** | **166** | **973** | **44.3** | **0.48** |
| **Houaphan** | **0.48** | **2** | **0.22** | **0.17** | **0.43** | **18** | **0.25** | **281** | **1,113** | **45.4** | **0.50** |
| **Louang Namtha** | **0.45** | **3** | **0.38** | **0.06** | **0.33** | **14** | **0.10** | **145** | **1,511** | **20.2** | **0.49** |
| Oudomxai | 0.42 | 4 | 0.30 | 0.00 | 0.44 | 19 | 0.00 | 265 | 962 | 42.5 | 0.50 |

| PROV | VUL | RNK | CHAZ | SENS | ADAP | PDEN | PROT | POP | INC | POV | HDI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MALAYSIA** | | | | | | | | | | | |
| Sabah | 0.23 | 1 | 0.31 | 0.04 | 0.07 | 33 | 0.06 | 2932 | 6,964 | 16.1 | 0.80 |
| Kelantan | 0.20 | 2 | 0.25 | 0.05 | 0.07 | 72 | 0.08 | 1506 | 4,358 | 12.5 | 0.81 |
| Pulau Pinang | 0.18 | 3 | 0.25 | 0.06 | 0.04 | 1,212 | 0.00 | 1469 | 15,682 | 1.9 | 0.88 |
| **PHILIPPINES** | | | | | | | | | | | |
| **National Capital Region** | **0.78** | **1** | **0.54** | **0.71** | **0.05** | **14,495** | **0.00** | **11600** | **6,205** | **4.3** | **0.81** |
| **Cordillera Adm. Region** | **0.51** | **2** | **0.70** | **0.05** | **0.13** | **78** | **0.07** | **1521** | **3,111** | **14.5** | **0.71** |
| **Central Luzon** | **0.50** | **3** | **0.67** | **0.11** | **0.09** | **541** | **0.12** | **9721** | **1,934** | **13.4** | **0.73** |
| **THAILAND** | | | | | | | | | | | |
| **Krung Thep** | **0.47** | **1** | **0.61** | **0.20** | **0.00** | **4,162** | **0.00** | **1232** | **18,710** | **0.5** | **0.88** |
| Samut Prakan | 0.41 | 2 | 0.59 | 0.09 | 0.03 | 1,853 | 0.00 | 1078 | 24,321 | 9.8 | 0.89 |
| Nonthaburi | 0.39 | 3 | 0.59 | 0.05 | 0.03 | 1,061 | 0.00 | 896 | 5,236 | 0.3 | 0.80 |
| Trang | 0.34 | 4 | 0.41 | 0.14 | 0.06 | 123 | 0.20 | 602 | 4,781 | 0.7 | 0.80 |
| Samut Sakhon | 0.34 | 5 | 0.54 | 0.03 | 0.03 | 538 | 0.00 | 452 | 31,051 | 0.8 | 0.90 |
| Chachoengsao | 0.31 | 6 | 0.43 | 0.08 | 0.04 | 134 | 0.11 | 648 | 14,963 | 4.9 | 0.86 |
| Surat Thani | 0.31 | 7 | 0.35 | 0.15 | 0.05 | 69 | 0.22 | 947 | 6,377 | 0.8 | 0.82 |
| Nakhon Si Thammarat | 0.29 | 8 | 0.40 | 0.07 | 0.06 | 153 | 0.10 | 1504 | 4,080 | 2.8 | 0.79 |
| Satun | 0.29 | 9 | 0.35 | 0.11 | 0.06 | 94 | 0.16 | 278 | 4,584 | 6.5 | 0.80 |
| Nakhon Nayok | 0.28 | 10 | 0.26 | 0.20 | 0.05 | 118 | 0.29 | 251 | 4,014 | 1.0 | 0.79 |
| Ranong | 0.26 | 11 | 0.33 | 0.10 | 0.06 | 47 | 0.14 | 178 | 4,950 | 0.3 | 0.80 |
| Uthai Thani | 0.25 | 12 | 0.11 | 0.27 | 0.08 | 44 | 0.40 | 327 | 2,899 | 8.7 | 0.76 |
| Phatthalung | 0.25 | 13 | 0.24 | 0.16 | 0.06 | 155 | 0.23 | 815 | 3,205 | 3.3 | 0.78 |
| Phetchaburi | 0.25 | 14 | 0.14 | 0.26 | 0.04 | 70 | 0.39 | 501 | 5,907 | 2.2 | 0.80 |
| Pattani | 0.24 | 15 | 0.36 | 0.02 | 0.07 | 309 | 0.00 | 21300 | 3,642 | 16.3 | 0.76 |
| Kanchanaburi | 0.24 | 16 | 0.09 | 0.29 | 0.06 | 40 | 0.43 | 826 | 4,074 | 8.8 | 0.79 |
| Nakhon Pathom | 0.24 | 17 | 0.39 | 0.02 | 0.03 | 381 | 0.00 | 809 | 8,029 | 0.5 | 0.83 |
| Tak | 0.24 | 18 | 0.08 | 0.26 | 0.09 | 29 | 0.39 | 522 | 3,506 | 20.9 | 0.75 |
| **VIETNAM** | | | | | | | | | | | |
| **Lai Chau** | **0.47** | **1** | **0.42** | **0.15** | **0.23** | **33** | **0.22** | **506** | **1,313** | **41.0** | **0.43** |
| Dong Thap | 0.43 | 2 | 0.65 | 0.03 | 0.06 | 498 | 0.01 | 1494 | 2,975 | 19.3 | 0.72 |
| Vinh Long | 0.42 | 3 | 0.64 | 0.03 | 0.05 | 586 | 0.00 | 1066 | 1,903 | 16.5 | 0.74 |
| Can Tho | 0.41 | 4 | 0.64 | 0.03 | 0.05 | 578 | 0.00 | 1814 | 2,123 | 14.9 | 0.72 |
| Tra Vinh | 0.38 | 5 | 0.55 | 0.02 | 0.10 | 443 | 0.00 | 958 | 1,841 | 30.7 | 0.68 |
| An Giang | 0.38 | 6 | 0.57 | 0.04 | 0.05 | 604 | 0.02 | 1976 | 2,084 | 13.6 | 0.69 |
| Tien Giang | 0.38 | 7 | 0.59 | 0.04 | 0.04 | 748 | 0.00 | 1657 | 1,839 | 17.4 | 0.73 |
| Soc Trang | 0.38 | 8 | 0.54 | 0.02 | 0.10 | 372 | 0.00 | 1194 | 1,393 | 29.8 | 0.68 |
| Ben Tre | 0.37 | 9 | 0.55 | 0.03 | 0.07 | 650 | 0.00 | 1340 | 1,663 | 31.7 | 0.72 |
| Thai Binh | 0.37 | 10 | 0.57 | 0.06 | 0.02 | 1,179 | 0.00 | 1813 | 1,493 | 9.9 | 0.77 |
| Minh Hai | 0.35 | 11 | 0.52 | 0.05 | 0.05 | 267 | 0.05 | 1752 | 2,034 | 21.4 | 0.72 |
| Long An | 0.33 | 12 | 0.53 | 0.02 | 0.04 | 334 | 0.00 | 1248 | 1,695 | 10.9 | 0.73 |
| Kien Giang | 0.33 | 13 | 0.49 | 0.03 | 0.05 | 251 | 0.03 | 1351 | 3,413 | 15.9 | 0.74 |

Notes:

1. VUL: Climate change vulnerability index; RANK: Rank of climate change vulnerability index (across SEA); CHAZ: Multiple climate hazard index; SENS: Sensitivity index; ADAP: Index of inverse adaptive capacity; PDEN: Population density in 2000 (population/km$^2$); PROT: Protected area (% of total area); POP: population (thousand); INC: per capita income in 2005 (US$PPP); POV: Poverty incidence; HDI: Human Development Index.
2. Color coding: High vulnerability: red bold; moderate vulnerability: black bold; mild vulnerability: black.